“University for Industry”

Addis Ababa Science and Technology University

College of Electrical and Mechanical Engineering

Department of Electrical and Computer Engineering

CURRICULUM FOR BACHELOR OF SCIENCE DEGREE IN ELECTRICAL ENGINEERING

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Addis Ababa, Ethiopia

Prepared by:

Electrical and Computer Engineering Department

Endorsement

This curriculum document is endorsed by the Addis Ababa Science and Technology University Senate

Date Endorsed

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Acronyms and Abbreviations

AASTU	Addis Ababa Science and Technology University
M	Mission
PEO	Program Educational Outcome
PO	Program Learning Outcome
CLO	Course Learning Outcome
L	Lecture
T	Tutorial
L	Laboratory
O	Other
GL	Guided Learning
IL	Independent Learning
F2F	Face-to-Face
NF2F	Non-Face-to-Face
SLT	Student Learning Time
EHEEE	Ethiopian Higher Education Entrance Examination
MoSHE	Ministry of Science and Higher Education

1. Introduction

1.1 Background

Addis Ababa Science and Technology University had a direct and reasonable connection with the Five-Year Growth and Transformation Plan (2010-2015) of the government of the Federal Democratic Republic of Ethiopia. As it was stated in the plan, the establishment of well institutionalized and strong science and technology universities and institutes of technology will serve as a cornerstone to build an economically developed and industrialized state of Ethiopia. As a result, AASTU was founded in 2011 under the Directive of the Council of Ministers No. 216/2011 by admitting the first batch of students which is around 2000 in November 2011.

1.2 Vision and Mission of the University

Vision

To be an internationally recognized Ethiopian Hub of science and technology with strong national commitment and significant continental impact by 2030.

Mission

- Delivering world-class education and training in strategically prioritized science and technology disciplines based on national economic demand,
- Conducting problem-solving applied research to support the productivity and competitiveness of industries,
- Serving as a center for knowledge and technological adaptation, innovation, and transfer,
- Building the technical and managerial capabilities of industries,
- Building a national hub of science and technology.

1.3 Background to the Program

This curriculum is developed to cater the demand of innovative, highly skilled, practice oriented, entrepreneur, and ethical manpower in the various fields of Electrical and Computer Engineering in five streams, namely, Communications Engineering, Computer Engineering, Control Engineering, Electronics Engineering, and Power Engineering.

Students will have options to choose their stream/focus area from the above five fields of specializations after successfully completing their fourth year second semester. A successful graduate of the program will not only be globally competent but also have active and decisive role in local industries. It will promote industrialization by motivating staff and students and offering consultancy services for prospective investors and entrepreneurs in the stage of industrial setup.

Moreover, this curriculum has special place in the history of the University in that it is designed according to the Washington Accord as an effort to accredit the entire Engineering program running in the University.

1.4 Rationale of the Program

Engineering in general and Electrical and Computer Engineering in particular is a highly dynamic field of study in which the rapid development of the technology doesn't allow existing academic curricula untouched for a long time. Thus, to minimize the gap between the state-of-the-art and the existing content and to maintain the relevance and educational standard, there is always a need for curricula review.

This revision of the curriculum is done based on the Washington Accord requirements. The basic rationale of this revision based on Washington Accord would equip our students to be internationally recognized graduates.

This newly revised Electrical and Computer Engineering degree program is a five years outcome-based program which includes national requirement courses, university specific requirement, industrial internship, integrated design project, and new trend in electrical and computer engineering that prepares graduates for professional engineering careers in areas such as communications, computing, control, electronics, and power systems. The education program provided is versatile and enables graduates to work in research, design, development, manufacturing, maintenance, quality control, technical support, consultation, and entrepreneurship.

2. Structure of the Program

The duration of study for Electrical and Computer Engineering degree in regular programs is five years. The total credit hours requirement, as stated in the University Senate Legislation article 91, is from 185 to 190. The general structure of the program is as described in Figure 1 and the credit-hours for each semester is shown in Table 2.

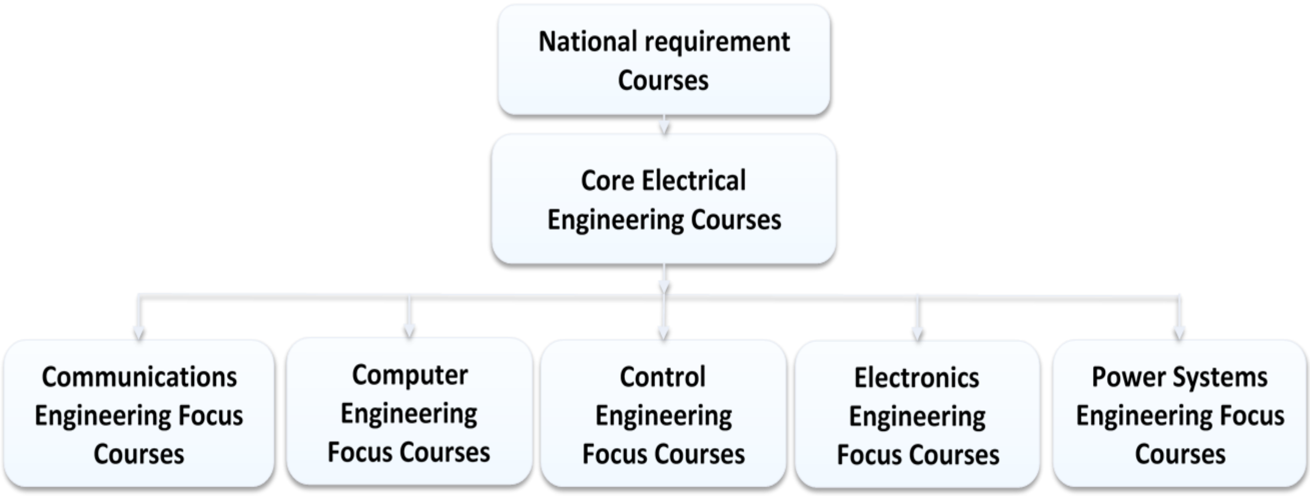

Figure 1: General Structure of the Program

2.1 Mission of the University

M-1: Delivering world-class education and training in strategically prioritized science and technology disciplines based on national economic demand,

M-2: Conducting problem-solving applied research to support the productivity and competitiveness of industries,

M-3: Serving as a center for knowledge and technological adaptation, innovation, and transfer,

M-4: Building the technical and managerial capabilities of industries,

M-5: Building a national hub of science and technology.

2.2 Program Education Objective (PEO)

The program education objectives shall describe accomplishments that the five years program graduates are expected to achieve in the first 3 to 5 years after graduation. The Department of Electrical and Computer Engineering has set the following program education objectives:

PEO1: The graduates will become professional engineers.

PEO2: The graduates will establish their own start-up companies.

PEO3: The graduates will be employed in high-ranking companies and universities locally and internationally.

PEO4: The graduates will be involved in research, design, and development works.

2.3 Mapping of PEO and University Mission

Table 1: PEO and university Mission Mapping

Mission / PEO	M-1	M-2	M-3	M-4	M-5
PEO1	√		√		√
PEO2		√	√		√
PEO3				√	
PE04				√	

2.4 Program Outcome (PO)

Program outcomes are statements that express the knowledge, skills and attitudes of graduates of this program. Apparently, they are extensions and summaries of graduate profiles presented above. For this program twelve Program Outcomes are identified as presented below:

PO1: Apply fundamental knowledge of mathematics, physics and various computational methods to analyze and solve electrical and computer engineering related problems.

PO2: Identify, formulate, research literature and analyze complex electrical and computer engineering problems reaching substantiated conclusions using first principles of mathematics, applied physics and engineering sciences.

PO3: Design solutions for complex engineering problems and systems, components and processes that met specified needs, and develop new solutions with appropriate considerations for public, health, safety, cultural, societal and environmental considerations.

PO4: Conduct experiments, analyze and interpret results, and apply research outcomes to develop new technologies and improve existing ones.

PO5: Create, select and apply appropriate techniques, resources and modern engineering and ICT tools, including prediction and modeling, to complex electrical and computer engineering problems, with an understanding of the limitations.

PO6: Apply contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practices and solutions to engineering problems.

PO7: Understand and evaluate the sustainability and impact of professional electrical and computer engineering works while solving complex engineering problems in societal and environmental contexts.

PO8: Ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments which must consider the impact of engineering solutions in global economic, environmental, and societal contexts.

PO9: Ability to work independently and as a team, and as a leader, motivating professionalism in multidisciplinary settings.

PO10: Communicate effectively, in both written and orally, on complex electrical and computer engineering activities with a variety of audiences.

PO11: Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work as a member and leader in a team, to manage projects in multi-disciplinary environments.

PO12: Recognize the personal, national, and global needs for, and the preparation and ability to engage in, independent and life-long learning in the broadest context of technological dynamism.

2.5 Mapping of PO and PEO

Table 2: Mapping of PO and PEO

PEO / PO	PEO1	PEO2	PEO3	PEO4
PO1	√			√
PO2	√		√	√
PO3	√	√	√	√
PO4	√	√	√	√
PO5	√		√	√
PO6	√	√		√
PO7		√		√
PO8	√	√	√	√
PO9		√		√
PO10	√			√
PO11		√		√
PO12	√			√

2.6 Admission Requirements

The minimum admission requirements for the undergraduate program are as stated in the Senate Legislation, article 78. Accordingly, admission to the undergraduate regular programs and CEP of AASTU is stated as follows:

2.6.1 Admission Requirements for Regular Undergraduate Program

Admission to the undergraduate programs of AASTU shall be based on the completion of the preparatory and obtaining the necessary pass marks in the Ethiopian Higher Education Entrance Examination (EHEEE) or equivalent academic achievements from foreign countries as well as our University entrance examination to be set by the MoSHE and/or AASTU.

2.6.2 Admission Requirements for Undergraduate CEP

Admission to the undergraduate CEP of AASTU shall be based on the completion of the preparatory and obtaining the necessary pass marks in the Ethiopian Higher Education Entrance Examination (EHEEE) or equivalent academic achievements from foreign countries as well as our University entrance examination to be set by AASTU.

2.7 Duration of Study

The duration for study of the undergraduate programs shall be as stated in the university senate legislation, article 90.1, which is five years.

2.8 Teaching and Learning Approach

Here in AASTU, the teaching and learning approach refer to the employed broad approaches to the learning and teaching activities. This may include a brief description of the range of teaching and learning methods used and other innovative features of the program related to teaching and advising students.

The teaching and learning methods may include student centered learning such as problem based learning, small group teaching, mini projects, group work, lectures, tutorial sessions, supervised study, student presentations, seminars, work-based learning, practical and development oriented design projects, readings and discussions, role-play, case study, laboratory based learning, computer based learning, invited speakers, independent studies, internship, field work, project work, practical, industrial visits, interactive or blended eLearning, lectures by industry professionals, classes and demonstrations or a combination of these and others. Evidence of the extent to which the teaching and learning approaches are student centered and aligned with the program learning outcomes should be indicated.

2.9 Program Type (Modes of Delivery)

The delivery of the program is based on two independent modes which are regular and continuing education program (CEP).

2.10 Assessment and Evaluation Mechanisms

Assessment and evaluation mechanisms of the program has the range and variety of assessment methods like viva voce, written examination, presentation, test, paper/essay, portfolio, report about an internship, report on fieldwork, continuous assessment, group or individual projects, summative assessment such as final exams, projects, problem solving assignments, peer senior essays, interactive computer and simulation assignments and group presentations, among others, which are selected based on the nature of the course and discretion of the instructor. For each course taken from freshman to graduation, assessment entry, and final grade generation will be done by the Student Information Management System (SIMS) software.

2.11 Grading System

Examinations are graded on letter grading system as stated in the University Senate Legislation Article 93. The same is shown in Table 3.

Table 3: Grading System

Raw Mark Interval (100%)	Corresponding Letter Grade	Corresponding Fixed Number Grade	Status Description	Class Description
[90,100]	A+	4.0	Excellent	First Class with Great Distinction
[85,90)	A	4.0		
[80,85)	A-	3.75		
[75,80)	B+	3.5	Very Good	First Class with Distinction
[70,75)	B	3.0		
[65,70)	B-	2.75	Good	First Class
[60,65)	C+	2.5		Second Class
[50,60)	C	2.0	Satisfactory	
[45,50)	C-	1.75	Unsatisfactory	Lower Class
[40,45)	D	1.0	Very Poor	
[0,40)	F	0	Fail	Lowest Class

2.12 Graduation Requirement

Graduation requirement for all undergraduate programs should satisfy the following minimum requirements as stated in the University Senate Legislation Article 109.

- All the required courses/modules and the minimum credit hours set in the program curriculum by the respective academic unit should be satisfied, except to phase in and phase out courses.
- A cumulative grade point average CGPA of 2.00 must be obtained overall.
- A cumulative grade point average CGPA of 2.00 in major area courses.
- No “F” grade in any course/module taken for undergraduate program.
- Student who fails to graduate due to less CGPA than the required or due to “F” grade have no more chance to upgrade their CGPA or to remove their “F”. However, they may be given Certificate of Attendance with their transcript stated as “Graduation Failure”
- Successfully defended his/her B.Sc. Thesis.

2.13 Degree Nomenclature

After a successful completion of all the requirements, a student graduating from the Electrical and Computer Engineering Department, in one of the respective focus areas, will be entitled to earn

In English:

“Bachelor of Science Degree in Electrical Engineering (Communications Focus Area)”

In Amharic:

“የሳይንስ ባችለር ዲግሪ በኤሌክትሪካል ምሕንድስና (በኮሚዩኒኬሺንስ የትኩረት መስክ)”

or

In English:

“Bachelor of Science Degree in Electrical Engineering (Computer Engineering Focus Area)”

In Amharic:

“የሳይንስ ባችለር ዲግሪ በኤሌክትሪካል ምሕንድስና (በኮምፒውተር ምሕንድስና የትኩረት መስክ)”

or

In English:

“Bachelor of Science Degree in Electrical Engineering (Control Focus Area)”

In Amharic:

“የሳይንስ ባችለር ዲግሪ በኤሌክትሪካል ምሕንድስና (በኮንትሮል የትኩረት መስክ)”

or

In English:

“Bachelor of Science Degree in Electrical Engineering (Electronics Focus Area)”

In Amharic:

“የሳይንስ ባችለር ዲግሪ በኤሌክትሪካል ምሕንድስና” (በኤሌክትሮኒክስ የትኩረት መስክ)

or

In English:

“Bachelor of Science Degree in Electrical Engineering (Power Focus Area)”

In Amharic:

“የሳይንስ ባችለር ዲግሪ በኤሌክትሪካል ምሕንድስና (በፓወር የትኩረት መስክ)”

2.14 Course Coding

Every course has been given an identification tag, characterized by four-digit code preceded by four letters. Accordingly, for Bachelor of Science Degree Program in Electrical and Computer Engineering the course coding has the following format:

ECEg1234

- **ECEg:** refers to the home base department which is Electrical and Computer Engineering.
- **The first number (1)**: refers to the year in which the subject is offered.
- **The second number (2)**: refers to the course category.
- **The last two numbers (3 & 4)**: refers to the number given to the semester the course is given, odd number for semester I and even number for semester II.

2.15 List of Courses and Categories

2.15.1 Course Category

There are eight course categories:

Category 0 = Common (National and University Requirement) Courses,

Category 1 = Core Compulsory Courses,

Category 2 = Elective Courses,

Category 3 = Communication Engineering Courses

Category 4 = Computer Engineering Courses

Category 5 = Control Engineering Courses

Category 6 = Electronics Engineering Courses

Category 7 = Power Engineering Courses

2.15.2 List of Common (both National and University Requirement) Courses

Table 4: List of Common Courses

№	Course Code	Course Name	Course Credit
1	Phil1009	Logic and Critical Thinking	3
2	Psyc1011	General Psychology	3
3	FLEn1003	Communicative English Language Skill I	3
4	GeEs1005	Geography of Ethiopia and the Horn	3
5	Math1007	Mathematics for Natural Science	3
6	SpSc1013	Physical Fitness	P/F
7	Phys1001	General Physics	3
8	FLEn1004	Communicative English Language Skill II	3
9	MCiE1012	Moral and Civic Education	2
10	Incl1010	Inclusiveness	2
11	Anth1002	Social Anthropology	2
12	Econ2009	Economics	3
13	GLTr2011	Global Trend	2
14	Hist2002	History of Ethiopia and the Horn	3
		Total Credit Hours	***35***

2.15.3 List of Core Compulsory Courses

Table 5: List of Core Courses

№	Course Code	Course Name	Course Credit
1	EmTe1108	Emerging Technology for Engineers	3
2	Entr1106	Entrepreneurship for Engineers	3
3	Math1014	Applied Mathematics IB	4
4	MEng2101	Engineering Drawing	3
5	Comp2003	Introduction to Computer Programming	3
6	CEng2103	Engineering Mechanics I (statics)	3
7	MEng2102	Engineering Mechanics II (Dynamics)	3
8	Math2007	Applied Mathematics IIB	4
9	Math2042	Applied Mathematics IIIB	4
10	MEng2114	Engineering Thermodynamics	3
11	ECEg2102	Fundamentals of Electrical Engineering	4
12	ECEg2110	Probability and Random Processes	3
13	ECEg3101	Computational Methods	3
14	ECEg3103	Applied Electronics I	4
15	ECEg3105	Signals and Systems Analysis	3
16	ECEg3107	Electromagnetic Fields	3
17	ECEg3109	Object Oriented Programming	3
18	ECEg3111	Research Methods and Presentations	2
19	ECEg3113	Electrical Workshop Practices I	1
20	ECEg3102	Applied Electronics II	3
21	ECEg3104	Digital Logic Design	4
22	ECEg3106	Network Analysis and Synthesis	3
23	ECEg3108	Digital Signal Processing	4
24	ECEg3110	Electrical Machines I	4
25	ECEg3112	Electrical Workshop Practices II	2
26	ECEg4101	Introduction to Communication Systems	3
27	ECEg4103	Computer Architecture and Organization	3

28	ECEg4105	Introduction to Control Systems	3
29	ECEg4107	Electrical Measurement and Instrumentation	3
30	ECEg4109	Power Systems I	3
31	IETP4115	Integrated Engineering Team Project	3
32	ECEg4102	Microprocessors and Interfacing	4
33	ECEg4112	Integrated Design Project	3
34	ECEg4100	Industry Internship	6
35	IEng5104	Industrial Management and Engineering Economy	3
36	ECEg5108	Final year project II	6
37	ECEg5107	Final year project I	P/F
		Total	***119***

2.15.4 List of Communications Engineering Focus Courses

Table 6: List of Communications Engineering Focus Courses

№	Course Code	Course Name	Course Credit
1	ECEg4304	Digital Communications System	4
2	ECEg4308	EM Waves and Guide Structures	4
3	ECEg5311	Telecommunication Networks	4
4	ECEg5301	Microwave Devices and Systems	3
5	ECEg5303	Fiber Optics Communications	4
6	ECEg5305	Antennas and Radio Wave Propagations	4
7	ECEg5307	Wireless and Mobile Communications	4
8	ECEg5302	Switching and Intelligent networks	3
		Total	***30***

2.15.5 List of Computer Engineering Focus Courses

Table 7: List of Computer Engineering Focus Courses

№	Course Code	Course Name	Course Credit
1	ECEg4406	Data Communications and Computer Networks	4
2	ECEg5410	Advanced Computer Networks	3
3	ECEg4404	Data Structures and Algorithm	4
4	ECEg4410	Data Base Systems	3
5	ECEg5409	Software Engineering	3
6	ECEg5401	Operating Systems	3
7	ECEg5403	Embedded Systems	4
8	ECEg5405	VLSI Design	3
9	ECEg5407	Introduction to Machine Learning	3
10	ECEg5402	New Trends in Computer Engineering	2
11	ECEg5412	Wireless Communications and Mobile Computing	4
		Total	***36***

2.15.6 Control Engineering Courses

Table 8: List of Control Engineering Focus Engineering

№	Course Code	Course Name	Course Credit
1	ECEg4510	Modern Control Systems	3
2	ECEg4506	Process Control Fundamentals	3
3	ECEg5509	Industrial Automation	4
4	ECEg5507	Digital Control Systems	3
5	ECEg5511	Robotics and Computer Vision	3
6	ECEg5502	Instrumentation Engineering	3
7	ECEg5510	Artificial Intelligence for Control Engineering	3
8	ECEg5503	Embedded Systems for Control Engineering	3
		Total	***25***

2.15.7 Electronics Engineering Courses

Table 9: List of Electronics Engineering Focus Courses

№	Course Code	Course Name	Course Credit
1	ECEg5606	Analog System Design	3
3	ECEg5609	Optoelectronics	4
4	ECEg5602	Digital Systems Design	4
5	ECEg5604	IC Technology	3
6	ECEg5605	Microelectronic Devices and Circuits	3
7	EEEg5608	Power Electronics	3
		Total	***20***

2.15.8 Power Engineering Courses

Table 10: List of Power Engineering Courses

№	Course Code	Course Name	Course Credit
1	ECEg4704	Electrical Machines II	4
2	ECEg5709	Power Systems Automation	4
3	ECEg4708	Power System II	4
4	ECEg5703	Energy Conversion and Rural Electrification	4
5	ECEg5711	Power System Protection	3
6	EEEg5701	Power Electronics and Electric Drives	4
7	ECEg5702	Power Systems Operation and Control	4
8	ECEg5705	Electrical Installation	3
		Total	***30***

2.15.9 Credit Hour Distribution

Table 11: Credit Hour Distribution of Communication Engineering Focus

Category		Total Cr. Hr	Percentage (%)
1	Core Course (major and supportive course)	116	61.38%
2	Core Elective/focus area course	36	18.51%
3	University requirement (Core)	3 Cr.hr	1.59%
Core Course Total Cr. hr		**154**	**81.48%**
4	National Requirement	35 Cr.hr	18.51%
Total Cr. hr		**190**	

Table 12: Credit Hour Distribution of Computer Engineering Focus

Category		Total Cr. hr	Percentage (%)
1	Core Course (major and supportive course)	116	61.05%
2	Core Elective/focus area course	36	18.95%
3	University requirement (Core)	3 Cr.hr	1.58%
Core Course Total Cr. hr		**155**	**81.58%**
4	National Requirement	35 Cr.hr	18.42%
Total Cr. hr		**190**	

Table 13: Credit Hour Distribution of Control Engineering Focus

Category		Total Cr. hr	Percentage (%)
1	Core Course (major and supportive course)	116	61.05%
2	Core Elective/focus area course	36	18.95%
3	University requirement (Core)	3 Cr.hr	1.58%
Core Course Total Cr. hr		**155**	**81.58%**
4	National Requirement	35 Cr.hr	18.42%
Total Cr. hr		**190**	

Table 14: Credit Hour Distribution of Electronics Engineering Focus

Category		Total Cr. hr	Percentage (%)
1	Core Course (major and supportive course)	116	61.05%
2	Core Elective/focus area course	36	18.95%
3	University requirement (Core)	3 Cr.hr	1.58%
Core Course Total Cr. hr		**155**	**81.58%**
4	National Requirement	35 Cr.hr	18.42%
Total Cr. hr		**190**	

Table 15: Credit Hour Distribution of Power Engineering Focus

Category		Total Cr. hr	Percentage (%)
1	Core Course (major and supportive course)	116	61.7%
2	Core Elective/focus area course	36	18.09%
3	University requirement (Core)	3 Cr.hr	1.6%
Core Course Total Cr. hr		**153**	**81.38%**
4	National Requirement	35 Cr.hr	18.62%
Total Cr. hr		**190**	

2.16 Semester Course Breakdown for Regular Programs

2.16.1 Basic Engineering Courses

Table 16: Semester Course Breakdown

First Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
Phil1009	Logic and Critical Thinking	3	2	3	0
Psyc1011	General Psychology	3	2	3	0
FLEn1003	Communicative English Language Skills I	3	2	3	0
GeES1005	Geography of Ethiopia and the Horn	3	2	3	0
Math1007	Mathematics for Natural Science	3	2	3	0
SpSc1013	Physical Fitness	0 (P/F)	1	0	3
Phys1001	General Physics	3	2	3	0
	Total	***18***	***13***	***18***	***3***

First Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
EmTe1108	Emerging Technology for Engineers	3	2	3	0
FLEn1004	Communicative English Language Skills-II	3	2	3	0
Math1014	Applied Mathematics IB	4	3	3	0
MCiE1012	Moral and Civic Education	2	2	0	0
Incl1010	Inclusiveness	2	2	0	0
Anth1002	Social Anthropology	2	2	0	0
Entr1106	Entrepreneurship for Engineers	3	3	0	0
	Total	***19***	***16***	***9***	***0***

Second Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
Comp2003	Introduction to Computer Programming	3	2	0	3
GLTr2011	Global Trend	2	2	0	0
MEng2101	Engineering Drawing	3	1	0	6
CEng2103	Engineering Mechanics I (Statics)	3	2	3	0
Math2007	Applied Mathematics IIB	4	3	3	0
Econ2009	Economics	3	2	3	0
	Total	***18***	***12***	***9***	***9***

Second Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg2102	Fundamentals of Electrical Engineering	4	2	3	3
MEng2102	Engineering Mechanics-II (Dynamics)	3	2	3	0
Math2042	Applied Mathematics IIIB	4	3	3	0
ECEg2110	Probability and Random Processes	3	2	3	0
MEng2114	Engineering Thermodynamics	3	2	3	0
Hist2002	History of Ethiopia and the Horn	3	2	3	0
	Total	***20***	***13***	***18***	***3***

Third Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg3101	Computational Methods	3	2	0	3
ECEg3103	Applied Electronics I	4	2	3	3
ECEg3105	Signals and System Analysis	3	2	3	0
ECEg3107	Electromagnetic Fields	3	2	3	0
ECEg3109	Object Oriented Programming	3	2	0	3
ECEg3111	Research Methods and Presentation	2	2	0	0
ECEg3113	Electrical Workshop Practices I	1	0	0	3
	Total	***19***	***12***	***9***	***12***

Third Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg3102	Applied Electronics II	3	2	0	3
ECEg3104	Digital Logic Design	4	2	3	3
ECEg3106	Network Analysis and Synthesis	3	2	3	0
ECEg3108	Digital Signal Processing	4	2	3	3
ECEg3110	Electrical Machines I	4	2	3	3
ECEg3112	Electrical Workshop Practices II	2	1	0	3
	Total	***20***	***11***	***12***	***15***

Fourth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4101	Introduction to Communication Systems	3	2	0	3
ECEg4103	Computer Architecture and Organization	3	2	3	0
ECEg4105	Introduction to Control Systems	3	2	0	3
ECEg4107	Electrical Measurement and Instrumentation	3	2	0	3
ECEg4109	Power Systems I	3	2	0	3
IETP4115	Integrated Engineering Team Project	3	1	0	6
	Total	***18***	***10***	***3***	***21***

2.16.2 Specialization Courses

I. Communication Engineering

Fourth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4102	Microprocessors and Interfacing	4	2	3	3
ECEg4304	Digital Communication Systems	3	2	0	3
ECEg4406	Data Communications and Computer Networks	4	2	3	3
ECEg4308	EM waves and Guide Structures	3	2	3	0
ECEg4112	Integrated Design Project	3	0	0	9
	Total	***17***	***8***	***9***	***18***

Fourth Year, Summer

Course Code	Course Title	Cr. Hrs	Lec	Tut.	Lab
ECEg4100	Industry Internship	6	0	0	18
	Total	***6***	***0***	***0***	***18***

Fifth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5301	Microwave Devices and Systems	3	2	0	3
ECEg5303	Fiber Optics Communications	3	2	0	3
ECEg5305	Antennas and Radio Wave Propagations	4	2	3	3
ECEg5307	Wireless and Mobile Communications	4	3	0	3
ECEg5605	Microelectronic Devices and Circuits	3	2	0	3
ECEg5311	Telecommunication Networks	3	2	3	0
ECEg5107	Final year project I	P/F			
	Total	***20***	***13***	***6***	***15***

Fifth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5302	Switching and Intelligent Networks	3	2	0	3
ECEg5410	Advanced Computer Networks	3	2	0	3
IEng5104	Industrial Management and Engineering Economy	3	2	3	0
ECEg5108	Final year project II	6	0	0	18
	Total	***15***	***6***	***3***	***24***

II. Computer Engineering

Fourth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4102	Microprocessors and Interfacing	4	2	3	3
ECEg4404	Data Structures and Algorithm	4	2	3	3
ECEg4410	Database Systems	3	2	0	3
ECEg4112	Integrated Design Project	3	0	0	9
ECEg4406	Data Communications and Computer Networks	4	2	3	3
	Total	***18***	***8***	***9***	***21***

Fourth Year, Summer

Course Code	Course Title	Cr. Hrs	Lec.	Tut.	Lab
ECEg4100	Industry Internship	6	0	0	18
	Total	***6***	***0***	***0***	***18***

Fifth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec.	Tut	Lab
ECEg5409	Software Engineering	3	2	3	0
ECEg5401	Operating Systems	3	2	0	3
ECEg5403	Embedded Systems	4	2	3	3
ECEg5405	VLSI Design	3	2	0	3
ECEg5407	Introduction to Machine Learning	3	2	0	3
ECEg5511	Robotics and Computer Vision	3	2	0	3
ECEg5107	Final year project I	P/F			
	Total	***19***	***12***	***6***	***15***

Fifth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5402	New Trends in Computer Engineering	2	2	0	0
ECEg5412	Wireless Communications and Mobile Computing	4	3	0	3
IEng5104	Industrial Management and Engineering Economy	3	2	3	0
ECEg5108	Final year project II	6	0	0	18
	Total	***15***	***7***	***3***	***21***

III. Control Engineering

Fourth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4510	Modern Control Systems	3	2	0	3
ECEg4704	Electrical Machines II	4	2	3	3
ECEg4506	Process Control Fundamentals	3	2	0	3
ECEg4112	Integrated Design Project	3	0	0	9
ECEg4102	Microprocessors and Interfacing	4	2	3	3
	Total	***17***	***8***	***6***	***21***

Fourth Year, Summer

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
EEEg4100	Industry Internship	6	0	0	18
	Total	**6**	**0**	**0**	**18**

Fifth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5701	Power Electronics and Electric Drives	4	2	3	3
ECEg5705	Electrical Installation	3	2	0	3
ECEg5503	Embedded Systems for Control Engineering	3	2	0	3
ECEg5507	Digital Control Systems	3	2	0	3
ECEg5511	Robotics and Computer Vision	3	2	0	3
ECEg5509	Industrial Automation	4	2	3	3
ECEg5107	Final year project I	P/F			
	Total	***20***	***12***	***6***	***18***

Fifth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5502	Instrumentation Engineering	3	2	0	3
ECEg5510	Artificial Intelligence for Control Engineering	3	2	0	3
IEng5104	Industrial Management and Engineering Economy	3	2	3	0
ECEg5108	Final year project II	6	0	0	18
	Total	***15***	***6***	***3***	***24***

IV. Electronics Engineering

Fourth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4102	Microprocessors and Interfacing	4	2	3	3
ECEg4304	Digital Communication Systems	3	2	0	3
ECEg4308	EM Waves and Guide Structures	3	2	3	0
ECEg4112	Integrated Design Project	3	0	0	9
ECEg5606	Analog System Design	3	2	3	0
ECEg5608	Power Electronics	3	2	0	3
	Total	***19***	***10***	***9***	***18***

Fourth Year, Summer

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4100	Industry Internship	6	0	0	18
	Total	***6***	***0***	***0***	***18***

Fifth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5301	Microwave Devices and Systems	3	2	0	3
ECEg5307	Wireless and Mobile Communications	4	3	0	3
ECEg5609	Optoelectronics	4	2	3	3
ECEg5605	Microelectronic Devices and Circuits	3	2	0	3
ECEg5405	VLSI Design	3	2	0	3
ECEg5107	Final year project I	P/F			
	Total	***17***	***11***	***3***	***15***

Fifth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5602	Digital Systems Design	4	2	3	3
ECEg5604	IC Technology	3	2	3	0
IEng5104	Industrial Management and Engineering Economy	3	2	3	0
ECEg5108	Final year project II	6	0	0	18
	Total	***16***	***6***	***9***	***21***

V. Power Engineering

Fourth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4510	Modern Control Systems	3	2	0	3
ECEg4704	Electrical Machines II	4	2	3	3
ECEg4102	Microprocessors and Interfacing	4	2	3	3
ECEg4112	Integrated Design Project	3	0	0	9
ECEg4708	Power Systems II	4	2	3	3
	Total	***18***	***8***	***9***	***21***

Fourth Year, Summer

Course Code	Course Title	Cr. Hrs	Lec.	Tut.	Lab
ECEg4100	Industry Internship	6	0	0	18
	Total	***6***	***0***	***0***	***18***

Fifth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5703	Energy Conversion and Rural Electrification	4	2	3	3
ECEg5711	Power System Protection	3	2	0	3
ECEg5701	Power Electronics and Electric Drives	4	2	3	3
ECEg5705	Electrical Installation	3	2	0	3
ECEg5709	Power Systems Automation	4	2	3	3
ECEg5107	Final year project I	P/F			
	Total	***18***	***10***	***9***	***15***

Fifth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5502	Instrumentation Engineering	3	2	0	3
ECEg5702	Power Systems Operation and Control	4	2	3	3
IEng5104	Industrial Management and Engineering Economy	3	2	3	0
ECEg5108	Final year project II	6	0	0	18
	Total	***16***	***6***	***6***	***24***

2.17 Course Plan

2.17.1 Common Courses

2.17.1.1 Logic and Critical Thinking

Addis Ababa Science and Technology University					
1	College: Natural and Social Science		Department: Social Science		
2	Course Category	Common Course			
	Course Name	Logic and Critical Thinking			
	Course Code:	Phil 1001			
3	**Synopsis:**	Logic and Critical Thinking is an inquiry that takes arguments as its basic objects of investigation and it is an exercise, a habit, a manner of perception and reasoning that has principles of rationality as its fulcrum, and dynamically involves various reasoning skills that ought to be human approach to issues and events of life. Logic and Critical Thinking enables to construct one's own sound argument and to evaluate the arguments of other's and evaluate arguments' validity, strengths and weaknesses.			
4	Name(s) of Academic Staff:	Biruk Shewadeg, Mohammod Zeinu, Shumye Getu (PhD), and Teshome Abera (PhD).			
5	Semester and Year offered:	Semester:	I	Year:	1
6	Credit Hour:	3			
7	Prerequisite/ Co-requisite: (if any)	No			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Analyze the philosophy, logic, and language nexus.			
	CLO2	Describe basic logical concepts, arguments, deduction, and induction.			
	CLO3	Cultivate the habits of critical thinking.			
	CLO4	Evaluate the nature and types of fallacies.			
	CLO5	Identify the four types of categorical proposition.			
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:				

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1			√										√				√	√			

	CLO2		√				√							√				√				
	CLO3			√													√			√		
	CLO4			√										√				√	√			
	CLO5…etc.						√							√		√			√	√		
	Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box																					

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Develop the habits of critical thinking.
	2	Acquire the ability of writing and communicating persuasively.
	3	Develop the techniques of constructing valid and sound argument.

11	Distribution of Student Learning Time (SLT)								
	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	Chapter 1: **Logic and Philosophy** 1.1 Introduction	1	6				3	5	14
	1.2 Meaning and Definition of philosophy	1							
	1.3 Core Branches of Philosophy	1							
	1.4 Importance of Learning Logic and Philosophy	1							
	Chapter 2: **Basic Concepts of Logic** 2.1 Introduction	2	10				8	8	26
	2.2 Basic Concepts of Logic	2							
	2.3 Techniques of recognizing arguments	2							
	2.4 Types of Arguments	2							
	2.5 Evaluation of Arguments	2							

	Chapter 3: **Logic and Language** 3.1 Introduction	3	6				3	3	12
	3.2 Logic and Meaning	3							
	3.3 Logic and Definition	3							
	3.4 Criteria for Lexical Definitions	3							
	Chapter 4: **Basic Concepts of Critical Thinking** 4.1 Introduction	2,3,4	5				6	7	18
	4.2 Meaning and Definition of Critical Thinking	2,4							
	4.3 Principles of Critical Thinking	2,4							
	4.4 Criterion/Standard of Argument Good Argument	2,3,4							
	4.5 Factors Affecting Critical Thinking	2,34							
	4.6 Relevance of Critical Thinking	2,4							
	Chapter 5: **Logical Reasoning and Fallacies** 5.1 Introduction	2,5	9				7	6	22
	5.2 Types of Fallacies: Formal and Informal	2,3,5							
	5.3 Categories of Informal Fallacies	2,5							
	Chapter 6: **Categorical Propositions**		5				7	8	20
	6.1 Introduction	6							
	6.2 The Components of	6							

	Categorical Propositions								
	6.3 Attributes of Categorical Propositions	6							
	6.4 Venn Diagrams and Square of Oppositions	6							
	6.5 Logical Operations: Conversion, Obversion, and Contraposition	6							
	Total		**41**				**34**	**37**	**112**

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	**Test I**	**20 %**	1		1
2	**Assignment I**	**15%**		2	2
3	**Test II**	**10%**	1		1
4	**Quiz**	**5 %**	1		1
5	Choose an item.				
				Total	**5**

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50%	3		3
			Grand Total SLT	**120**

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face

Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room …etc.)	1	Choose an item.
		2	Choose an item.
		3	Choose an item.
		4	Choose an item.
		5	Choose an item.
13	**Text book**	1.	Hurley, Patrick J. (2014) A Concise Introduction to Logic, 12th Edition, Wadsworth, Cengage Learning.

	References	1.	Copi, Irving M.and Carl Cohen, (1990) Introduction to Logic, New York: Macmillan Publishing Company.
		2.	Stephen, C. (2000) The Power of Logic. London and Toronto: Mayfield Publishing company.
		3.	Fogelin, Robert, J, (1987) Understanding Arguments: An Introduction to Informal Logic, New York: Harcourt Brace Jvanovich Publisher.
		4.	Damer, Edward. (2005). Attacking faulty reasoning. A practical guide to fallacy free argument. Wadsworth Cengage learning, USA.

2.17.1.2 General Psychology

Addis Ababa Science and Technology University						
1	College: Natural and Social Science			Department: Social Science		
2	Course Category	Common Course				
	Course Name	General Psychology				
	Course Code:	*Psyc 1011*				
3	Synopsis:	The course encompasses the fundamental concepts and principles of psychology and psychological processes which have immense applications to human life and to develop life skills based on the theories and principles of psychology.				
4	Name(s) of Academic Staff:	Awoke Mihretu, Mihret Abraham, Geta Walelegn, Wondwossen Girma, and Gashaw Tesfa				
5	Semester and Year offered:	Semester:	I	Year:	1	
6	Credit Hour:	3				
7	Prerequisite/ Co-requisite: (if any)	None				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Differentiate the branches of Psychology, various research methods and types of Psychological Disorders.				
	CLO2	Discuss the importance of life skills and the process of perception, memory and forgetting				
	CLO3	Apply the different learning theories, academic, social and intra-personal skills in various situations.				
	CLO4	Analyze the major theories of personality, motivation and emotion.				
	CLO5	Evaluate major perspectives in psychology and treatment techniques of psychological disorder.				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Individual Assignment	Quiz	Group Assignment	Final Examination
CLO1				√									√			√	√				√
CLO2												√	√				√				√
CLO3										√			√			√		√		√	√
CLO4									√				√				√		√		√

CLO5				√									√							√	√

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1.	Ability to define psychology, Differentiating Psychology from Common sense, Identifying the different fields of Psychology and Identify the different approaches and research skills in Psychology.
2.	Cognitive (e.g., creativity and information management). Communication (e.g., active listening and public speaking). Personal (e.g., conscientiousness and integrity). Social (e.g., collaboration and leadership abilities).
3.	Problem-Solving **-** learn to apply strategies & approaches for understanding problems as well as learn to identify practical steps for implementing solutions.
4.	Critical Evaluation **-** learn to assess whether evidence for a phenomenon is accurate or not and how to identify the shortcomings and pitfalls of a particular line of action.

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O+			
Chapter One: Essence of Psychology	CLO1 & CLO5	5				1	6	12
a. Definition of Psychology and Related Concepts								
b. Goals of Psychology								
1.3. Historical Background and Major Perspectives in Psychology								
1.4. Branches/Sub-fields of Psychology								
1.5. Research Methods in Psychology								
Chapter Two: Sensation and Perception	CLO2	3				1	3	7
2.1. The meanings of sensation and perception								
2.2. sensory laws: Sensory Thresholds and Sensory Adaption								
2.3. Perception								

	Chapter Three: Learning and Theories of Learning	**CLO3**	6			1	2	6	15
	3.1. Definition, Characteristics and Principles of Learning								
	3.1. Factors Influencing Learning								
	3.2. Theories of Learning and their Applications								
	Chapter 4: Memory and Forgetting	CLO2	2				1	3	6
	4.1. Memory								
	4.2. Forgetting								
	4.3. Improving Memory								
	Chapter 5: Motivation and Emotions	CLO4	3				1	3	7
	5.1. Motivation								
	5.2. Emotions								
	Chapter Six: Personality	**CLO4**	4				2	4	10
	6.1. Meaning of Personality 6.2. Measures of Personality **6.3.** Theories of Personality								
	Chapter Seven: Psychological Disorders and their Treatment Techniques	**CLO1 &** CLO5	5			1	1	5	12
	7.1. Nature of Psychological Disorders								
	7.2. Causes of Psychological Disorders								
	7.3. Types of Psychological Disorders								
	7.4. Treatment Techniques								
	Chapter Eight: Introduction to Life Skills	**CLO2**	1				1	1	3

	8.1. Nature and Definition of Life skills 8.2. Components of Life Skills **8.3.** Goals of Life Skills								
	Chapter Nine: Intra-Personal Skills	**CLO3**	3			1	1	3	8
	9.1. Self-Concept and Self-Awareness 9.2. Self-esteem and self-confidence 9.3. Self-Control 9.4. Anger Management 9.5. Emotional Intelligence and Managing Emotion 9.6. Stress, Coping with Stress and Resilience 9.7. Critical and Creative Thinking 9.8. Problem Solving and Decision Making								
	Chapter Ten: Academic Skills	**CLO3**	3				1	3	7
	10.1. Time Management 10.2. Note-taking and Study Skills 10.3. Test-Taking Skill 10.4. Test Anxiety and Overcoming Test Anxiety 10.5. Goal Setting 10.6. Career Development Skill								
	Chapter Eleven: Social Skills	**CLO3**	3			1	1	3	8

	11.1. Understanding cultural Diversity 11.2. Gender and Social Inclusion 11.3. Interpersonal Communication Skills 11.4. Social Influences 11.5. Peer Pressure 11.6. Assertiveness 11.7. Conflict and Conflict Resolution 11.8. Team Work 11.9. Overcoming Risky Behavior								
	Total		38			4	13	40	95

**

Assessment

Continuous Assessment		Percentage Total - 50 (%)	F2F	NF2F	SLT
1	Tests I	10	1	2	3
2	Individual Assignments	10		2	2
3	Test II	15	1	2	3
4	Group Assignment	10	3	4	7
5	Quiz	5	1		1
				Total	16

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	3	6	9
			Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face

Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room …etc.)	1	General Psychology Module
13	**Text Book**		Ministry of Science and Higher Education (MoSHE) (2019). **General Psychology**

			(Psyc1011) Module. Addis Ababa: Author.
	Reference	1	Coon, D. & Mitterer, J.O. (2008). *Introduction to psychology: Gateways to mind and behavior* (12th ed). New York, NY: McGraw Hill.
		2	Feldman, R.S. (2018). *Essentials of understanding psychology* (13th ed). New York, NY: McGraw Hill.
		3	Kalat, J.W. (2013). *Introduction to psychology* (13th ed). New York, NY: McGraw Hill.
		4	Lahey, B.B. (2008). *Psychology: An introduction* (10th ed). New York, NY: McGrawHill.

2.17.1.3 Communicative English Skills I

<table>
<tr><td colspan="7">Addis Ababa Science and Technology University</td></tr>
<tr><td>1</td><td colspan="2">College: Natural and Social Sciences</td><td colspan="4">Department: English</td></tr>
<tr><td rowspan="3">2</td><td>Course Category</td><td>Common Course</td><td colspan="4">Module Code: FLEn 1011</td></tr>
<tr><td>Course Name</td><td colspan="5">Communicative English Language Skills I</td></tr>
<tr><td>Course Code:</td><td colspan="5">FLEn 1003</td></tr>
<tr><td>3</td><td>Synopsis:</td><td colspan="5">This course will cover specific language aspects such as developing basic functions of English language skills such as reading, listening, writing, speaking, vocabulary and grammar.</td></tr>
<tr><td>4</td><td>Name(s) of Academic Staff:</td><td colspan="5"></td></tr>
<tr><td>5</td><td>Semester and Year offered:</td><td>Semester:</td><td>1st semester</td><td>Year:</td><td>1st year</td><td></td></tr>
<tr><td>6</td><td>Credit Hour:</td><td colspan="5">3</td></tr>
<tr><td>7</td><td>Prerequisite/ Co-requisite: (if any)</td><td colspan="5">Non</td></tr>
<tr><td rowspan="4">8</td><td colspan="6">Course Learning Outcome (CLO): At the end of the course the student will be able to do:</td></tr>
<tr><td>CLO1</td><td colspan="5">Speak with accuracy, fluency, and confidence using appropriate expressions in different contexts.</td></tr>
<tr><td>CLO2</td><td colspan="5">Explain and infer various reading and listening materials.</td></tr>
<tr><td>CL</td><td colspan="5">Write well-structured texts.</td></tr>
</table>

	CLO3	
	CLO4	Apply variety of grammatical skills in various communicative contexts
	CLO5	Make use of contextual clues to acquire meanings of unfamiliar words from context.

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
													Teaching Methods				Assessment				
			PO3	PO4	PO5	PO6	PO7		PO9	PO10	PO11	PO12	L	T	P	O	Test			Project	
CLO1										√			√	√					√		
CLO2										√			√	√			√	√	√		
CLO3										√			√	√			√	√			
CLO4										√			√	√			√		√		
CLO5										√			√	√				√	√		

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1	Public speaking and individual presentation skills
2	Mastery of macro and micro skills
3	Cooperative learning

11 Distribution of Student Learning Time (SLT)

		Teaching and Learning Activities	T

1	Course Content Outline	CLO	Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	otal (SLT)
			L	T	P	O			
	Chapter 1: : Study Skills 1.1 Listening: What is a lecture?	1, 2, 3	1	2				2	5
	1.2 Grammar focus: Modals and infinitives for giving advice	1, 2, 3	1	1				1	3
	1.3 Reading: Reading for study	1, 2, 3	0.5	1				1	2 .5
	1.4 Grammar focus: Present perfect tense	1, 2, 3, 4, 5	1	1				1	3
	1.5 Reflections	1, 2, 3, 4, 5	0.5	1				1	2 .5
	1.6 Self-assessment	1, 2, 3, 4, 5	0.5	1				1	2 .5
	1.7 Summary	1,	0.5	1				1	2.

		2, 3, 4, 5							5
	Chapter 2: Health and Fitness 2.1 Listening: Zinedine Zidane	1, 2, 3	0.5	1				1	2.5
	2.2 Conditionals	1, ,3 ,4 ,5	1	1				1	3
	2.3 Reading: Health and fitness	1, 2, 3	1	1				1	3
	2.4 Vocabulary: Guessing meaning from context	1, 2, 3	1	1				2	4
	2.5 Reflections	1, 2, 3, 4, 5	0.5	1				1	2.5
	2.6 Self-assessment	1, 2, 3, 4, 5	0.5	1				1	2.5
	2.7 Summary	1, 2, 3,	0.5	1				1	2.5

		4, 5							
	Chapter 3: Cultural Values	1, 2, 3	0.5	1				1	2.5
	3.1 Listening: Cultural tourism	1, 2, 3	1	2				1	4
	3.2 Grammar focus: The present simple, past simple, present perfect and past perfect in contrast	1, 3, 4, 5	1	2				2	5
	3.3 Strategies for improving English grammar knowledge	1, 3, 4, 5	1	1				1	3
	3.4 Reading: The Awramba community	1, 2, 3	1	1				1	3
	3.5 Reflections	1, 2, 3, 4, 5	0.5	1				1	2.5
	3. 6 Self-assessment	1, 2, 3, 4, 5	0.5	1				1	2.5
	3.7 Summary	1, 2,	0.5	1				1	2.5

		3, 4, 5							
	Chapter 4: Wildlife	1, 2, 3	0.5	1				1	2.5
	4.1 Listening: Human-wildlife interaction	1, 2, 3	1	1				1	3
	4.2 Reading: Africa‘s wild animals	1, 2, 3	1	1				1	3
	4.3 Vocabulary: Denotative and connotative meanings	1, 2, 3	1	1				1	3
	4.4 Grammar focus: Conditionals revised	1, 3, 4 5	1	1				1	3
	4.5 Reflections	1, 2, 3, 4, 5	0.5	1				1	2.5
	4.6 Self-assessment	1, 2, 3, 4, 5	0.5	1				1	2 .5
	4.7 Summary	1, 2,	0.5	1				1	2 .5

		3, 4, 5							
	Chapter 5: Population	1, 2, 3	0.5	1				1	2.5
	5.1 Listening: Population density	1, 2, 3	1	1				1	3
	5.2 Reading: Population pyramid	1, 2, 3	1	1				1	3
	5.3 Vocabulary: Collocation	1, 2, 3	1	1				1	3
	5.4 Grammar Focus: Voice	1, 3, 4, 5	1	2				2	5
	5.5 Reflections	1, 2, 3, 4, 5	0.5	1				1	2.5
	5.6 Self-assessment	1, 2, 3, 4, 5	0.5	1				1	2.5
	5.7 Summary	1,	0.5	1				1	2

	2, 3, 4, 5							.5
Total		28	42				42	112

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Debate	10 %	0.5	0.5	1
2	Speech Delivery	10 %	0.5	0.5	1
3	Group Assignment	10 %		2	2
4	Reading and Grammar	10 %	1	2	3
5	Listening	10 %	1		1
Total					

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50 %	3	5	8
Grand Total SLT				120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face

Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course (e.g. software, computer lab, simulation	1	Listening: Language Lab
		2	Extra Reading materials
		3	Supplementary grammar exercises
		4	Open speaking sessions
		5	Choose an item.

	room …etc.)		
13	Text book and reference: (note: ensure the latest edition /publication)	1	Alfassi, M. 2004. Reading to learn: Effects of combined strategy instruction on high school students. Journal of Educational Research, 97(4):171-184
		2	Bade, M. 2008. Grammar and good language learners. In C. Griffiths (Eds.). Lessons from good language learners (pp. 174-184). Cambridge University Press. https//doi.org/10.107/CBO9780511497667.016
		3	Bouchard, M. 2005. Reading comprehension strategies for English language learners: 30research-based reading strategies that held students read, understand and really learn content from their textbooks and other nonfiction materials. New York: Scholastic.
		4	Murphy R. (?). Essentials of English grammar in use: A self-study reference and practice book for intermediate students of English (2nd Ed.). Cambridge University Press.
		5	Department of Foreign Language and Literature. 1996. College English (Volume I and Volume II). Addis Ababa University Press.

2.17.1.4 Geography of Ethiopia and the Horn

Addis Ababa Science and Technology University						
1	College: Natural and Social Science			Department: Social Science		
2	Course Category	Common Course				
	Course Name	Geography of Ethiopia and the Horn				
	Course Code:	GeES 1002				
3	Synopsis:	This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.				
4	Name(s) of Academic Staff:	Dagmawie Tesfaye (PhD)				
5	Semester and Year offered:	Semester:	I	Year:	1	
6	Credit Hour:	3				
7	Prerequisite/ Co-requisite: (if any)	None				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Demonstrate basic knowledge on the geographic attributes of Ethiopia and Horn.				
	CLO2	Acquire general understanding of physical geographic processes, and human-environment relationships.				
	CLO3	Develop ethical aptitudes and dispositions necessary to live in harmony with the natural environment				
	CLO4	Develop an understanding of national population distributional patterns and dynamics				
	CLO5.	Describe the comparative advantages of economic regimes; and understand the impacts of globalization.				
2	CLO 6	Identify their country's overall geographic conditions and opportunities;				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1													√				√				
CLO2													√					√			
CLO3							√		√				√		√				√		
CLO4									√				√					√			
CLO5….		√											√			√	√				

CLO 6						√						√	√				√				

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Develop a map reading skill
	2	Locate a place on a map using longitude and latitude

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Introduction **1.1. Geography: Definition, scope, themes and approaches**	1	3	2				5	10
1.2 . Location, Shape and Size of Ethiopia and the Horn								
1.2.1. Location and its effects								
1.2.2. The shape of Ethiopia and its implication								
1.2.3. The size of Ethiopia and its implications								
1.3. Basic Skills of Map Reading								
Chapter 2: The geology of Ethiopia and the horn 2.1. NTRODUCTION	2	3	3				6	12
2.2 The Geologic Processes: Endogenic and Exogenic Forces								
2.3. The Geological Time scale and Age Dating Techniques								
2.4. Geological Processes and the Resulting Landforms 2.4.1. The Precambrian Era geologic processes and resultant features								
2.4.2. The Paleozoic Era geologic processes and resultant features								
2.4.3. The Mesozoic Era geologic processes and resultant features								
2.4.4. The Cenozoic Era geologic processes and resultant features								
2.5. Rock and Mineral Resources of Ethiopia								
Chapter 3: The Topography of Ethiopia and the Horn 3.1. Introduction	3	2	3				5	10

	3.2. Physiographic Divisions							
	3.2.1 The Western Highlands and Lowlands .							
	3.2.2 The Southeastern Highlands and Lowlands							
	3.2.3 The Rift Valley							
	3..3. The Impacts of Relief on Biophysical and Socioeconomic Conditions							
	Chapter 4: Drainage systems and water resources of Ethiopia and the horn 4.1. Introduction	3	3	3			6	12
	4.2. Major Drainage Systems of Ethiopia							
	4.3. Water Resources: Rivers, Lakes, and Subsurface Water							
	4.4. General Characteristics of Ethiopian Rivers							
	4.5. Water Resources Potentials and Development in Ethiopia							
	Chapter 5: The climate of Ethiopia and the horn 5.1. Introduction	5	4	3			7	14
	5.2. Elements and Controls of Weather and Climate							
	5.3. Spatiotemporal Patterns and Distribution of Temperature and Rainfall in Ethiopia							
	5.4. Agro-ecological Zones of Ethiopia							
	5.5. Climate and its Implications on Biophysical and Socioeconomic Aspects							
	5.6. Climate Change/Global Warming: Causes, Consequences and Response Mechanisms							
	Chapter 6. : Soils, natural vegetation and wildlife resources of Ethiopia and the horn	6	3	3			6	12
	6.1. Introduction							
	6.2. Ethiopian Soils: Types, Degradation and Conservation							
	6.3. Types and Distribution of Natural Vegetation in Ethiopia							
	6.4. Natural vegetation: Uses, Degradation and Conservation Strategies							
	Chapter 7. Population of Ethiopia and the horn	4	5	5			10	20

	7.1 Introduction								
	7.2. Population Data: Uses and Sources								
	7.3. Population Dynamics: Fertility, Mortality and Migration								
	7.4. Population Distribution and Composition								
	7.5. Sociocultural Aspects of Ethiopian Population: Education, Health and Language								
	Chapter 8. Economic activities in Ethiopia	6	4	4				8	16
	8.1. Introduction								
	8.2. Mining, Fishing and Forestry								
	8.3. Agriculture in Ethiopian								
	8.3. 1.. Contributions, potentials and characteristics of agriculture in Ethiopia								
	8..32. Agricultural systems in Ethiopia								
	8.3.3. Major problems of Ethiopian agriculture								
	8.4. Manufacturing in Ethiopia								
	8.4.1. Manufacturing: essence and contributions								
	8.4.2. Types, characteristics and distribution of manufacturing								
	8.4.3. Industrial development in Ethiopia: Challenges and Prospects								
	8.5. The Service Sector in Ethiopia								
	8.5.1. Transportation and communication in Ethiopia: types, roles and characteristics								
	8.5.2. Trade in Ethiopia: types, contributions and characteristics								
	8.5.3. Tourism in Ethiopia: Types, major tourist attraction sites, challenges and prospects								
	Total		27	26				53	106

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	15%	1		1
2	Assignments	10%	1	1	2
3	Tests	10%	1	1	2
4	Assignments	10 %	1	1	2

	5	Quiz	5 %	1		1
					Total	14
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50 %	2	4	6
					Grand Total SLT	120
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					
12	Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room …etc.)	1	Choose an item.			
		2	Choose an item.			
		3	Choose an item.			
		4	Choose an item.			
		5	Choose an item.			
13	**Text book**		Ministry of Science and Higher Education Moral and Civic Education Module.			
	Reference	1	Morgan R.P.C (2005). Soil Erosion and Conservation. National Soil Resources Institute, Cornfield University. Blackwell Publishing, Oxford, UK			
		2	Assefa M., Melese W., Shimelis G. (2014). *Nile River Basin; Eco hydrological Challenges, Climate Change and Hydro politics*. Springer International Publishing, Switzerland.			
		3	Robert, E.G, James, F.P & L. MichaelT. (2007). *Essentials of Physical Geography*. Thomson Higher Education, Belmont, 8th edition...			
		4	Addis Ababa University (2001*). Introductory Geography of Ethiopia*, Teaching Text, Department of Geography.			

2.17.1.5 Mathematics for Natural Science

	Addis Ababa Science and Technology University	
1	College: **Natural and Social Science**	Department: **Mathematics**
2	Course Category	Common
	Course Name	**Mathematics (For natural science)**
	Course Code:	Math 1007
3	Synopsis:	This course covers the basic concepts of logic and set theory, the real and complex number systems, Mathematical induction, least upper bound and greatest lower bound, functions and types of functions, polynomial and rational functions, logarithmic and exponential functions, trigonometric functions, hyperbolic functions and their graphs and analytic geometry.
4	Name(s) of Academic Staff:	
5	Semester and Year offered:	Semester: I Year: 1
6	Credit Hour:	3
7	Prerequisite/ Co-requisite: (if any)	None
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Analyze basic concepts of logic and set theory.
	CLO2	Describe the fundamental properties of real and complex numbers system.
	CLO3	Identify basic properties of functions.
	CLO4	Analyze basic concepts of analytic geometry.
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√	√											√	√			√	√			
CLO2	√	√											√	√			√		√		
CLO3	√	√											√	√				√			
CLO4	√	√											√	√							

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)

	1	knowledge of understanding and analyzing mathematical equations.
	2	Skill of understanding and analyzing mathematical equations.
	3	Knowledge of understanding and analyzing mathematical word problems.
	4	Skill of understanding and solving mathematical problems.
	5	Knowledge for understanding mathematical context for the next courses.
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: **Proportional Logic and Set Theory** 1.1 Definition and examples of proportion 1.2 Logical proportions 1.3 Compound (or complex) proportions 1.4 Tautology and contradiction 1.5 Open proportion and quantifiers 1.6 Set Theory 1.7 The concept of a set 1.8 Description of sets 1.9 Set operations and Venn diagrams	CL01	5	7	0	0	2	10	24
Chapter 2: **The real and complex number systems** 2.1 The real number system 2.2 he natural numbers, principle of Mathematical induction and the well ordering Principle 2.3 The integers, rational numbers and real numbers 2.4 Upper bound and lower bound: least upper bound and greatest lower bound; completeness property of real numbers 2.5 Complex number system 2.6 Definition of complex numbers and their operations 2.7 Polar representation of complex	CLO2	5	7	0	0	2	10	24

	numbers and the De-Moivere's formula 2.8 Extraction of roots								
	Chapter 3: **Functions** 3.1 Review of relations and functions 3.2 Real-valued functions and their properties 3.3 Types of functions and inverse of a function 3.4 Polynomials, zeros of polynomials, rational functions, and their graphs 3.5 Definitions and basic properties of logarithmic, exponential, trigonometric and hyperbolic functions, and their graphs	CLO3	4	7	0	0	2	13	26
	Chapter 4: **Analytic Geometry** 4.1 The straight-line: Division of segments and various forms of equation of a line 4.2 Circles 4.3 Definition of circles and examples 4.4 Equation of circle center at the origin and different from the origin 4.5 Intersection of a circle and a line 4.6 Parabola 4.7 Definition of parabola and standard form of equation of parabola 4.8 Equation of parabola parallel to the x-axis(the y-axis) 4.9 Ellipse 4.10 Definition of ellipse and examples 4.11 Equation of ellipse center at the origin and different from the origin 4.12 Hyperbola 4.13 Definition of hyperbola and examples 4.14 Equation of hyperbola of center at the origin transverse axis to x-axis (the y-axis)	CLO4	7	10	0	0	2	15	34

<table>
<tr><td rowspan="12"></td><td colspan="3">Total</td><td></td><td>21</td><td>31</td><td>0</td><td>0</td><td>8</td><td>48</td><td>108</td></tr>
<tr><td colspan="11">Assessment</td></tr>
<tr><td colspan="2">Continuous Assessment</td><td>Percentage Total-50(%)</td><td>F2F</td><td>NF2F</td><td>SLT</td></tr>
<tr><td>1</td><td>Tests</td><td>25%</td><td>1</td><td>1</td><td>2</td></tr>
<tr><td>2</td><td>Assignments</td><td>20%</td><td>2</td><td>1</td><td>3</td></tr>
<tr><td>3</td><td>Quize</td><td>5%</td><td>0.5</td><td>1</td><td>1.5</td></tr>
<tr><td colspan="5">Total</td><td>6.5</td></tr>
<tr><td colspan="2">Final Exam</td><td>Percentage 50 (%)</td><td>F2F</td><td>NF2F</td><td>SLT</td></tr>
<tr><td colspan="2">Final Exam</td><td>50%</td><td>3</td><td>2.5</td><td>5.5</td></tr>
<tr><td colspan="5">Grand Total SLT</td><td>120</td></tr>
<tr><td colspan="11">L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.</td></tr>
</table>

<table>
<tr><td>12</td><td>Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room …etc.)</td><td colspan="2"></td></tr>
<tr><td rowspan="6">13</td><td rowspan="6">Text book and reference:
(note: ensure the latest edition /publication)</td><td rowspan="2">1</td><td>Text book:
➢ Alemayehu haile and yismaw alemu, mathematics an introductory course,AAU, Department of Mathematics
➢ Ministry of Science and Higher Education: Mathematics for Natural Science Module 2020.</td></tr>
<tr><td>References</td></tr>
<tr><td>1</td><td>AberaAbay, An introduction to Analytic Geometry, AAU, 1998</td></tr>
<tr><td>2</td><td>set theory and logic, supplementary materials, Math 103:</td></tr>
<tr><td>3</td><td>Fundamental concept in Mathematics, Yismaw Alemu</td></tr>
<tr><td>4</td><td>Contemporary Mathematics with Applications, A. Calini, E. Jurisich, S. Shields, 2008:</td></tr>
</table>

2.17.1.6 Physical Fitness

Addis Ababa Science and Technology University						
1	College: Natural and Social Science		Department: Social Science			
2	Course Category	Common				
	Course Name	Physical Fitness				
	Course Code:	**SpSc 1013**				
3	Synopsis:	This course covers:- Concepts of physical fitness, the health benefits of physical activity, making well-informed food choices, health related components of fitness and principles of exercise prescription and assessment of fitness components				
4	Name(s) of Academic Staff:	Mesfin Mengesh, Beshir Edo and Ali Wale				
5	Semester and Year offered:	Semester:	I	Year:	1	
6	Credit Hour:	2				
7	Prerequisite/ Co-requisite: (if any)					
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	State the basic Concepts of physical fitness conditioning exercise				
	CLO2	Identify the Health Benefits of Physical Activity				
	CLO3	Recognize Making Well-Informed Food Choices				
	CLO4	Demonstrate Health related components of fitness and principles of exercise prescription				
	CLO5…etc.	Demonstrate Assessments of fitness components				

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignm	Practice Exam	Lab-report
CLO1										✓			✓		✓				✓	✓	
CLO2							✓						✓				✓				
CLO3						✓							✓				✓				
CLO4									✓		✓		✓		✓					✓	
CLO5…etc.												✓	✓		✓					✓	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	**Develop healthy and fitness long life skills**

2.17.1.7 General Physics

Addis Ababa Science and Technology University						
1	College: Natural and Social Science			Department: Physics		
2	Course Category	Common Module				
	Course Name	General Physics				
	Course Code:	Phys1001				
3	Synopsis:	This algebra based introductory course is designed to enable students to learn the basic concepts, principles and applications of elementary physics. The topics include vectors, Kinematics & Dynamics of Particles, Fluids Mechanics, Heat and Thermodynamics, Oscillations, waves and optics, Electromagnetism & Electronics, Cross Cutting Applications of Physics.				
4	Name(s) of Academic Staff:					
5	Semester and Year offered:	Semester:	I	Year:	1	
6	Credit Hour:	3				
7	Prerequisite/ Co-requisite: (if any)	None				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Measure physical quantities in the laboratory with appropriate attention to minimizing possible sources of random and systematic errors.				
	CLO2	Analyze the kinematics and dynamics of particles using the basic physics laws such as Newton's laws of motion and gravitation, and the laws of conservations of energy and linear momentum				
	CLO3	Solve problems of fluid mechanics by applying continuity equation, Bernolli's equation, and thermodynamics problems by applying the first law of thermodynamics and concepts of heat capacity.				
	CLO4	Use the laws of electromagnetism, such as Coulomb's law, Faraday's Law, and Kirchhoff's rules, to solve problems.				
	CLO5	Identify the cross cutting applications of physics knowledge in different streams.				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
													Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1				√									√		√						√
CLO2	√												√	√	√		√	√	√		√

	CLO3		√											√	√	√				√		
	CLO4				√									√	√	√		√	√			
	CLO5													√			√				√	
	Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box																					

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Develop analytical skills through Lab.
	2	Develop Communication skills
	3	Develop Problem Solving Skills

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: **Preliminaries** 1.1 Physical Quantities and Units of Measurement 1.2 Uncertainty in Measurement and Significant Digits 1.3 Vectors: composition and resolution 1.4 Unit Vectors	1	2	3				3	8
Chapter 2: **Kinematics & Dynamics of Particles** 2.1 Displacement, Velocity and Acceleration in 1D and 2D 2.2 Motion with Constant Acceleration 2.3 Free Fall Motion 2.4 Projectile motion 2.5 Particle Dynamics and Planetary Motions 2.5.1 The Concept of Force as a Measure of Interaction 2.5.2 Types of forces 2.5.3 Newton's Laws of Motion and Applications 2.5.4 Circular Motion 2.5.5 Newton's Law of Universal Gravitation and Examples 2.5.6 Kepler's laws, satellites motion and weightlessness 2.6 Work, Energy and Linear Momentum 2.6.1 Work and Energy 2.6.2 Linear Momentum 2.6.3 Conservation of Energy and Linear Momentum / Collisions 2.6.4 Power 2.6.5 The Concept of Center of Mass	1,2,3	6	9	1			9	25

	Chapter 3: Fluids Mechanics 3.1 Properties of Bulk Matter 3.2 Density and Pressure in Static Fluids 3.3 Buoyant Forces, Archimedes' principle 3.4 Moving Fluids & Bernoulli's Equation	3,4	3	4.5				3.5	11
	Chapter 4: **Heat & Thermodynamics** 4.1 The Concept of Temperature: Zeroth Law of Thermodynamics 4.2 The Concept Heat and Work 4.3 4.3 Specific Heat and Latent Heat 4.4 Heat Transfer Mechanism 4.5 Thermal Expansion 4.6 First Law of Thermodynamics	3,4	3	4.5	1			4.5	13
	Chapter 5: Oscillations, Waves and Optics 5.1 Simple Harmonic Motion 5.2 The Simple Pendulum 5.3 Wave and Its Characteristics 5.4 Resonance 5.5 Doppler Effect 5.6 Image formation by thin lens	3,4	4	6	1			4	15
	Chapter 6: Electromagnetism & Electronics 6.1 Coulomb's Law and Electric Fields 6.2 Electric Potential 6.3 Current, Resistance and Ohm's Law 6.4 Electrical Power 6.5 Equivalent Resistance & Kirchhoff's Law 6.6 Magnetic Field and Magnetic Flux 6.7 Electromagnetic Induction 6.8 Insulators, Conductors, Semiconductors 6.9 Diodes / Characteristics Curve 6.10 Transistors	3, 5	4	6	1			6	17
	Chapter 7: Cross Cutting Applications of Physics 7.1 Application in Agriculture 7.1.1 Energy balance concept, energy balance in soils, moisture content, soil densities, soil moisture characteristics 7.2 Physics and Industries 7.2.1 Principle of Motor and generator 7.3 Physics in Health Sciences and Medical Imaging 7.3.1 Radiation and its biological effect, x-ray, MRI, Ultrasound 7.4 Physics and Archeology 7.4.1 Radioactive Dating 7.5 Application in Earth and Space Sciences 7.5.1 Geothermal Energy, Seismometer, Radio and TV communications 7.6 Application in Power Generation	6	2	3				3	8

7.6.1 Solar and Wind								
Total		24	36	4			33	97

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	25%	2	2	4
2	Assignments	5%	1	2	3
3	Lab-report	15%	1	6	7
4	Quize	5%	1		1
				Total	15

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50%	2	6	8
			Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face

Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room …etc.)	1	Choose an item.
		2	Choose an item.
		3	Choose an item.
		4	Choose an item.
		5	Choose an item.
13	Text book and reference: (note: ensure the latest edition /publication)	1	General Physics Module
		2	Serway, R. A. and Vuille, C., 2018, College Physics, 11th ed., Cengage Learning, Boston, USA
		3	Physics for Scientists and Engineers with Modern Physics by Douglas C. Giancoli
		4	Herman Cember and Thomas A. Johnson, Introduction to Health Physics, 4th ed., (2008).
		5	William R. Hendee and E. Russell Ritenour, Medical Imaging Physics, 4th ed., (2002).

2.17.1.8 Communicative English Language Skills II

Addis Ababa Science and Technology University					
1	College: **Natural and Social Sciences**		Department: English		
2	Course Category Common Course				
	Course Name	Communicative English Language Skills II			
	Course Code:	FLEn 1004			
3	Synopsis:	Communicative English Language Skills II Module is a continuation of Communicative English Language skills I Module, and it mainly aims to provide first year University students proficiency with speaking, listening, reading and writing skills.			
4	Name(s) of Academic Staff:				
5	Semester and Year offered:	Semester:	**2nd semester**	Year:	**1st year**
6	Credit Hour:	3			
7	Prerequisite/ Co-requisite: (if any)	Communicative English Language Skills I			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Speak with accuracy, fluency, and confidence using appropriate expressions in different contexts.			
	CLO2	Distinguish various reading and listening materials.			
	CLO3	Write well-structured texts.			
	CLO4	Apply variety of grammatical skills in various communicative contexts			
	CLO5…etc.	Make use of contextual clues to acquire meanings of unfamiliar words from context.			
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:				

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods	Assessment				
														Test	Quiz	Assi	Proj	Lab-repo

														L	T	P	O					
	CLO1										√			√	√					√		
	CLO2										√			√	√			√	√	√		
	CLO3										√			√	√			√	√			
	CLO4										√			√	√			√		√		
	CLO5										√			√	√				√	√		
	Indicate the relevancy between the CLO and PO by ticking “√”on the appropriate relevant box																					

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Public speaking
	2	Independent learning and individual writing
	3	Cooperative learning

11	Distribution of Student Learning Time (SLT)								
	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	Chapter 1: Life Skills 1.1 Reading passage: The concept of life skills	1,2,3	2	3				2	7
	1.2 II Grammar: Active and passive voices	1,2,3	1	2				2	5
	1.3 Reading: Reading for study	1,2,3	1	2				2	5
	1.4 Speaking	1,2,3 ,4,5	1	2				2	5
	Chapter 2: Speculations about the future of Science 2.1 Speculations about the future of Science	1,2,3	2	2				2	6

	2.2 Grammar: Future Tense	1,,3, 4,5	1	2				2	5
	2.3 Speaking	1,2,3	2	2				2	6
	2.4 Writing	1,2,3	1	2				2	5
	Chapter 3: Environmental protection 3.1 Reading: Environmental Challenges: A river run through it	1,2,3	1	2				2	5
	3.2 Grammar: Modal verbs	1,3,4 ,5	2	2				2	6
	3.3 Speaking	1,3,4 ,5	2	2				2	6
	3.4 Writing	1,2,3	1	2				2	5
	Chapter 4: Indigenous Knowledge 4.1 Reading: A local Pathway to Global Development	1,2,3	1	2				2	5
	4.2 Grammar: Reported Speech	1,2,3	2	2				2	6
	4.3 Speaking	1,2,3	1	2				2	5
	4.4 Writing	1,3,4 5	2	2				2	6
	Chapter 5: Cultural Heritage 5.1 I Reading: Cultural Heritage What is it? Why is it important	1,2,3 1,2,3	1	2				2	5
	5.2 Grammar: Relative Clauses	1,2,3	1	2				2	5

	5.3 Speaking	1,2,3	1	2				2	5
	5.4 Writing	1,3,4 ,5	2	3				2	7
	Total		28	42				40	110

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Debate	10 %	0.5	0.5	1
2	Speech Delivery	10 %	0.5	0.5	1
3	Group Assignment	10 %	0.5	0.5	1
4	Reading and Grammar	10 %	0.5	0.5	1
5	Paragraph writing	10 %	0.5	0.5	1
				Total	5

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50 %	3	2	5
			Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face

Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room …etc.)	1	Extra writing books
		2	Extra Reading materials
		3	Supplementary grammar exercises
		4	Open speaking sessions
		5	Choose an item.
13	Text book and reference:	1	Azar, B. S. (2003). Fundamentals of English grammar. Longman.
		2	Eggenschwiler, J.,& Biggs, E.D. (2001). Writing:Grammar, Usage, and Style. New York.Hungry Minds. Inc
		3	Lucy, J. A., & Lucy, L. A. (Eds.). (1993). Reflexive Language:

	(note: ensure the latest edition /publication)		Reported Speech andMeta pragmatics. Cambridge University Press.
		4	Murphy, R. (2012). English Grammar in Use. Ernst Klett Sprachen.
		5	Naylor, H., & Murphy, R. (2007). Essential Grammar in Use. Supplementary Exrcises. With Answers. Ernst Klett Sprachen

2.17.1.9 Moral and Civic Education

Addis Ababa Science and Technology University						
1	College: Natural and Social Science			Department: Social Science		
2	Course Category	Common Course				
	Course Name	Moral and Civic Education				
	Course Code:	MCiE1012				
3	Synopsis:	This course generally covers basic understanding of civics and ethics, approaches of ethical decision-making, moral judgment, state and government, Constitution, Democracy and Human Rights. In so doing students will have basic knowledge of their duties and rights besides the understanding of theories of state, morality and global issues.				
4	Name(s) of Academic Staff:	Biruk Shewadeg, Sophia Kiflie, Solomon Gebre, Shumye Getu,Teshome Abera, Mengistu Gutema				
5	Semester and Year offered:	Semester:	II	Year:	1	
6	Credit Hour:	2				
7	Prerequisite/ Co-requisite: (if any)					
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Define the subject matter of Civics and Ethics.				
	CLO2	Cultivate certain moral values and civic virtues that enable them to be morally matured and competent in their professional and citizenry lives				
	CLO3	Appreciate and recognizing, and tolerance towards diversity and difference by building the culture of peace.				
	CLO4	Identify the theoretical discourses and practices of state, government and citizenship in the context of Ethiopia.				
	CLO5	Analyze the essences of democracy, human rights, constitution and constitutionalism.				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Co urs e Lea	Program Learning Outcomes (PO)												
	P	P	P	P	P	P	P	P	P	P	P	P		Assessment

														Teaching Methods				Test	Quiz	Assignment	Project	Lab-report
														L	T	P	O					
	CLO1	√												√					√			
	CLO2		√																√			
	CLO3						√											√		√		
	CLO4						√							√				√		√		
	CLO5									√								√				
	Indicate the relevancy between the CLO and PO by ticking “√”on the appropriate relevant box																					

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Enable students to be good and responsible citizens.
	2	Students will be active participant in the socio-economic and political aspects of their country.
	3…etc.	Self-reliant and ethical individuals are the direct result of teaching this course.

11	Distribution of Student Learning Time (SLT)								
	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	Chapter 1:**Understanding Civics and Ethics** 1.1 Defining Civics, Ethics, Morality and amorality	CLO 1&5	3				1	2	6
	1.2 The Origin and Development of Civics and ethical education								
	1.3. The purpose of civics and ethical education								
	1.4. Citizens’ Rights and responsibilities								
	1.5. Competences of good citizen								
	Chapter 2: **Approaches to Ethics** 2.1.Normative ethics	CLO 1,2,3	6				2	12	20
	2.1.1TeleologicalEthics(Consequentialist)								
	2.1.2. Deontological Ethics (Non-								

	Consequentialist)								
	2.1.3. Virtue Ethics and Civic Virtues								
	2.2. Non-Normative Ethics								
	2.2.1. Meta Ethics								
	2.3. Issues in Applied Ethics								
	2.3.1. Development Ethics								
	2.3.2. Environmental Ethics								
	2.3.3. Professional Ethics								
	Chapter 3: **Ethical Decision Making and Moral Judgments** 3.1. Ethical Principles and Values of Moral Judgments	CLO 3,5	2				2	5	9
	3.2 The principle of equal consideration of interest								
	3.3. Conflicting goals and ethical Justifications								
	3.4. Ethical values and Justifiable exceptions								
	3.5. Why Should I act ethically?								
	Chapter 4: **State, Government and Citizenship** 4.1. Understanding State	CLO 4,5	6				2	11	19
	4.1.1. What is a state?								
	4.1.2. Attributes of State								
	4.1.3.State Structures								
	4.2. Understanding Government								
	4.2.1. Major Function and Purpose of Government								
	4.2.2. Types of Government: Limited and Unlimited								

	4.2.3 Systems of Government								
	4.3. Understanding Citizenship								
	4.3.1.Inclusion and exclusion in Citizenship								
	4.3.2.Ways of Acquiring Citizenship								
	4.3.3.Ways of Losing Citizenship								
	4.3.4.Citizenship in Ethiopian Context: Past and Present								
	4.4. State Formation and Nation-building in Ethiopian Context								
	Chapter 5: **Constitution, Democracy and Human Rights** 5.1. Constitution and Constitutionalism	CLO 4,5	6				2	8	16
	5.1.1. Peculiar features of Constitution								
	5.1.2. Major Purpose and Functions of Constitution								
	5.1.3. Classification of constitutions								
	5.1.4. The Constitutional Experience of Ethiopia: pre and post 1931								
	5.2 .Democracy and Democratization								
	5.2.1. Definitions and Forms of Democracy								
	5.2.2. Views on Democracy: Substantive and Procedural Views								
	5.2.3. Fundamental Values and Principles of Democracy								

	5.2.4. Democratization and Its Waves								
	5.2.5. Major actors in Democratization Process								
	5.2.6. Democracy and Good Governance in Ethiopia								
	5.3 Human Rights								
	5.3.1. Definitions and Nature of Human Rights								
	5.3.2. Basic Characteristics of Human Rights								
	5.3.3. Dimensions of Human Rights								
	5.3.4. The Protection and Promotion of Human Rights								
	5.3.5. Human Rights Instruments: Documents								
	5.3.6. Oversight Mechanisms: Institutions								
	Total		23				9	38	**70**

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	15%	√		1
2	Quize	5%	√		1
3	Assignments	15%	√	√	2
4	Others	25%(Mid exam)	√		2
5					
				Total	**6**
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		40%	2	2	**4**
				Grand Total SLT	**80**

	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.		
12	Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room …etc.)	1	Choose an item.
		2	Choose an item.
		3	Choose an item.
		4	Choose an item.
		5	Choose an item.
13	**References**	1	Alexander, Larry (eds.). (1998). Constitutionalism: Philosophical Foundations. Cambridge: Cambridge University Press.
		2	Assefa Fisseha. (2006). Federalism and Accommodation of Ethnic Diversity in Ethiopia: Comparative Study. Utrecht: Wolf Legal Publishers
		3	Fasil Nahum. 1997. Constitution for a Nation of Nations: The Ethiopian Prospect. Lawrenceville,NJ: Red Sea Publishers.
		4	Goodin,Robert E. 2005. Reflective Democracy.Oxford University Press: New York.
	Text Book		Ministry of Science and Higher Education Moral and Civic Education Module.

2.17.1.10 Inclusiveness

Addis Ababa Science and Technology University						
1	College: Natural and Social Science			Department: Social Science		
2	Course Category	Common				
	Course Name	Inclusiveness				
	Course Code:	SNIE 1002				
3	Synopsis:	The course will provide concepts of disabilities/vulnerabilities and inclusiveness, application of assessment strategies for service provision, skills of demonstrating inclusive culture and introduce the existing national and international legal frameworks. In addition, the course will offer techniques on establishing partnership with stakeholders and apply inclusiveness for peace, democracy and development.				
4	Name(s) of Academic Staff:	Awoke Mihretu, Mihret Abraham, Getaw Walelegn, Wondwossen Girma, and Gashaw Tesfa				
5	Semester and Year offered:	Semester:	II	Year:	1	
6	Credit Hour:	2				
7	Prerequisite/ Co-requisite: (if any)	None				

8	Course Learning Outcome (CLO): At the end of the course the student will be able to:
CLO1	Describe disabilities, vulnerabilities and Inclusiveness concepts
CLO2	Apply various assessment strategies for service provisions
CLO3	Demonstrate features of inclusive culture in peace, democracy, and development
CLO4	Appraise the existing legal frame work and resources allocation for inclusion
CLO5	Establish partnership with stakeholders

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test I	Individual Assignment	Quiz	Group Assignment	Final Examination
CLO1												√	√			√	√				√
CLO2				√								√	√			√	√				√
CLO3												√	√					√			√
CLO4				√									√					√			√
CLO5									√				√			√			√		√

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1	Promote the characteristics of vulnerable People for better coexistence in society
2	Encourage the culture for inclusiveness
3	Apply indigenous inclusive values in practices
4	Demonstrate problem solving skills for inclusive services provisions in different sectors.

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Understanding Disabilities and Vulnerabilities 1.1 Definitions of disability and vulnerability 1.2 Types of disabilities and	CLO1	4			1		5	10

	vulnerabilities 1.3 Causes of disability and vulnerability 1.4 Historical movements from segregation to inclusion 1.5 The effects of attitude on the move towards inclusion 1.6 Models of disability								
	Chapter 2: Concept of Inclusion 2.1 Definition inclusion 2.2 Principles of inclusion 2.3 Rationale for inclusion 2.4 Features inclusive environment	CLO1	3					4	7
	Chapter 3: Identification, Assessment & Differentiated services 3.1 Level of disabilities for support 3.2 Needs and potentials of persons with disabilities 3.3 Needs and potentials of persons with vulnerabilities 3.4 Assessment and evaluation Availability of legal frameworks in line with inclusion 3.5 Assessment and evaluation inclusiveness of the sector plans 3.6 Assessment and evaluation attitude towards inclusion 3.7 Assessment and evaluation of accessibilities of social and physical environments 3.8 Assessment and evaluation of strategies and plans that remove social and physical barriers to facilitate inclusiveness 3.9 The components and purpose of differentiated service plans **3.10** Assistive technologies and software to enhance inclusion.	**CLO2**	3			1		5	9

	Chapter 4: Promoting Inclusive Culture 4.1 Definition of Inclusive Culture 4.2 Dimensions of Inclusive culture 4.3 Policy related to Inclusive Culture 4.4 Building inclusive community 4.5 Means of establish inclusive culture 4.6 Inclusive values 4.7 Indigenous inclusive values and practices	CLO3	3					4	7
	Chapter 5: Inclusion for Peace, Democracy and Development 5.1. Definition of Peace, Democracy and development from the perspective of Inclusiveness 5.2. Sources of exclusionary practices 5.3. Exclusionary practices in the community 5.4. Respecting divers needs, culture, values, demands and ideas 5.5. Conflict emanated from exclusion 5.6. The full participation of the marginalized group of people 5.7. The democratic principles for inclusive practices 5.8. The importance of inclusion for psychosocial development 5.9. The importance of inclusion for economic development 5.10. The importance of inclusion for peace	CLO3	3					4	7

	Chapter 6: Legal frame work 6.1. Components of legal framework 6.2. International legal frame works in relation to inclusiveness 6.3. National legal frame works in relation to inclusiveness	**CLO4**	2					3	5
	Chapter 7 Resources Management for Inclusion • Resources for inclusion • Planning for inclusion services	**CLO4**	3					4	7
	Chapter 8: Collaborative Partnerships with stakeholders 8.1. Definition of collaboration, partnership and stack holder 8.2. Key elements of successful collaboration 8.3. Benefits and challenges of collaboration of stakeholders for the success of inclusion 8.4. The strategies for effective co-planning and team working 8.5. Characteristics of successful stockholders partnerships 8.6. Strategies for community involvement	**CLO5**	3			1		5	9
	Total		24			3		34	61

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test I	10	1	2	3
2	Individual Assignments	10		3	3
3	Test II	15	1	2	3
4	Group Assignment	10		3	3
5	Quiz	5	1		1

<table>
<tr><td rowspan="4"></td><td colspan="4" align="right">Total</td><td>13</td></tr>
<tr><td>Final Exam</td><td>Percentage 50 (%)</td><td>F2F</td><td>NF2F</td><td>SLT</td></tr>
<tr><td>Final Exam</td><td>50</td><td>2</td><td>4</td><td>6</td></tr>
<tr><td colspan="4" align="right">Grand Total SLT</td><td>80</td></tr>
<tr><td></td><td colspan="5">L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.</td></tr>
</table>

12	Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room …etc.)	1	None
13	**Text book**	1	Ministry of Science and Higher Education (MoSHE) (2019). **INCLUSIVENESS** (**SNIE 1012**) Module, Addis Ababa, Ethiopia.
	Reference	2	Alemayehu Teklemariam and Temsegen Fereja (2011). Special Need Education in Ethiopia: Practice of Special Needs Education around the World. Washington: Gallaudet University Press.
		3	Alemayehu Teklemariam (2019). Inclusive Education in Ethiopia: WILEY and Blackwell: Singapore
		4	Tirussew Teferra and Alemayehu Teklemariam (2007). Including the Excluded: Integrating disability into EFA Fast Track Initiative Process and National Education Plans in Ethiopia. World Vision

2.17.1.11 Social Anthropology

Addis Ababa Science and Technology University						
1	College: Natural and Social Science		Department: Social Science			
2	Course Category	Common Course				
	Course Name	Social Anthropology				
	Course Code:	Anth1002				
3	Synopsis:	This course as a freshman course gives an understanding of different key areas of anthropological inquiry: family, means of production, political organizations, social organization, language, religion, and gender				
4	Name(s) of Academic Staff:	Teshome Abera (PhD)				
5	Semester and Year offered:	Semester:	II	Year:	1	
6	Credit Hour:	2				
7	Prerequisite/ Co-requisite: (if any)	None				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Develop a critical perspective in order to acquire a detailed and Dynamic understanding of culture society and Characteristic feature of culture				
	CLO2	Understand the cultural and biological diversity of humanity and unity in diversity across the world and in Ethiopia;				
	CLO3	Analyze and discuss different forms of marginalization in society and the problem of ethno centrism				
	CLO4	Identify customary systems of governance and conflict resolution institutions of the various peoples of Ethiopia;				
	CLO5	Describe the significance of Indigenous knowledge				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1						√			√				√				√				
CLO2			√			√			√												
CLO3						√			√				√						√		

	CLO4						√						√	√					√			
	CLO5						√	√						√				√		√		
	Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box																					

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	• Develop written communication skill
	2	• Develop Analytical and critical thinking skills.
	3	• Acquire problem solving skills.
	4	• Develop the ability to construct an argument skill
	5	• Internilize clear, logical and independent thinking skill.

11	Distribution of Student Learning Time (SLT)								
	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	Unit1. introducing Anthropology and its Subject Matter 1.1.Definition, Scope and Subject Matter of Anthropology 1.2.Sub-fields of anthropology 1.3. Unique (Basic) Features of Anthropology. 1.4.Misconceptions about anthropology 1.5.The Relationship between Anthropology and Other Disciplines 1.6.The Contributions of anthropology 1.7. Unit Summary	CLO1	3				1	3	7
	Unit 2: Human Culture and	CLO1							

	Ties that Connect 2.1 Conceptualizing Culture: What Culture is and What Culture isn't		4					4	8
	2.2 Characteristic Features of Culture								
	2.3 Aspects/Elements of Culture								
	2.4. Cultural Unity and Variations: Universality, Generality and Particularity of Culture								
	2.5. Evaluating Cultural Differences: Ethnocentrism, Cultural Relativism and Human Rights								
	2.6. Culture Change								
	2.7. Ties That Connect: Marriage, Family and Kinship								
	2.8. Unit Summary								
	Unit 3: Human Diversity, Culture Areas and Contact in Ethiopia **3.1 Human Beings & Being Human: What it is to be human?**	CLO2	3				1	3	7
	3.2 Origin of the Modern Human Species: Homo sapiens sapiens								
	3.3 The Kinds of Humanity: human physical variation								
	3.4 Human Races: the history of racial typing								
	3.5 he Grand Illusion: Race, turns out, is arbitrary								
	3.6 Why is Everyone Different? Human Cultural Diversity/Variation								
	3.7 Culture area and cultural contact in Ethiopia								

	Unit4.Marginalized,Minorities, and Vulnerable Groups 4.1 Definition of concepts	CLO3	3					3	6
	4.2 Gender-based marginalization Female genital cutting								
	4.3 Marginalized occupational groups								
	4.4 Age-based vulnerability								
	4.5 Religious and ethnic minorities								
	4.6 Human right approaches and inclusiveness: Anthropological perspectives								
	4.7. Unit Summary								
	Unit 5: Identity, Inter-Ethnic Relations and Multiculturalism in Ethiopia 5.1 Identity, Ethnicity and Race: Identification and Social Categorization	CLO3	3				1	3	7
	5.2 Conceptualizing Ethnicity – What's it?								
	5.3 Ethnic Groups and Ethnic Identity								
	5.4 Race –The Social Construction of Racial Identity								
	5.5 Theories of Ethnicity: Primordialism, Instrumentalism and Social Constructivism								
	5.6 Instrumentalist (Situational) Theory of Ethnicity								
	5.7 Unit Summary								
	Chapter 6: Customary and Local	CLO4,							

	Governance Systems and Peace Making 6.1. Indigenous and local governance		3					3	6
	6.2. Intra and inter-ethnic conflict resolution institutions								
	6.3.Inter-ethnic conflict resolution								
	6.4. Women's role in conflict resolution and peace-making								
	6.5.Legal pluralism: interrelations between customary, religious and state legal systems								
	6.6. Unit Summary								
	U**nite 7 Indigenous Knowledge Systems (IKS) and Practices** 7.1. Definition of concepts	CLO 5	4				1	3	8
	7.2. Significance of indigenous knowledge								
	7.3. Indigenous knowledge and development								
	7.4. Preservation, Challenges and Limitations of IK								
	7.5. The Erosion of Indigenous Knowledge Systems(IKS)								
	7.6. Unit summary								
	7.7.								
	Total		**23**				**4**	**23**	**49**

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	15	1		1
2	Assignments	10		12	12
3	Tests	10	1		1
4	Quize	5	1		1
5	Assignments	10		12	12

<table>
<tr><td rowspan="4"></td><td colspan="4">Total</td><td>27</td></tr>
<tr><td>Final Exam</td><td>Percentage 50 (%)</td><td>F2F</td><td>NF2F</td><td>SLT</td></tr>
<tr><td>Final Exam</td><td>100%</td><td>2</td><td>2</td><td>4</td></tr>
<tr><td colspan="4">Grand Total</td><td>80</td></tr>
<tr><td></td><td colspan="5">L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.</td></tr>
</table>

<table>
<tr><td rowspan="5">12</td><td rowspan="5">Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room …etc.)</td><td>1</td><td>Choose an item.</td></tr>
<tr><td>2</td><td>Choose an item.</td></tr>
<tr><td>3</td><td>Choose an item.</td></tr>
<tr><td>4</td><td>Choose an item.</td></tr>
<tr><td>5</td><td>Choose an item.</td></tr>
<tr><td rowspan="5">13</td><td>Text book</td><td></td><td>Ministry of Science and Higher Education Social Anthropology Module.</td></tr>
<tr><td rowspan="4">Reference</td><td>1</td><td>Kottak, Conrad Phillip, 2011 Anthropology, Appreciating Human Diversity. Random House, New York.</td></tr>
<tr><td>2</td><td>Salzman, P.C. & Rice P. C. 2004 Thinking Anthropologically: a practical guide for students.Pearson/Prentice Hall, Upper Saddle River, New Jersey</td></tr>
<tr><td>3</td><td>Podolefsky & Brown 1996 Applying Anthropology Mayfield Pub. Co. Mountain View California</td></tr>
<tr><td>4</td><td>Dip Kapoor And Edward Shizha(2010). Indigenous Knowledge And Learning In Asia/Pacific And Africa Perspectives On Development, Education, And Culture. Palgrave Macmillan.USA</td></tr>
</table>

2.17.1.12 Economics

	Addis Ababa Science and Technology University	
1	College: Natural and Social Science	Department: Business Management

2	Course Category	Common Course
	Course Name	Economics
	Course Code:	**Econ2009**
3	Synopsis:	This course is an introductory course covering basic principles and issues of economics. Broadly speaking, the course has two components, microeconomics and macroeconomics. In microeconomics, the focus is on the way in which individual economic agents – workers, consumers, households and firms – make decisions. This part begins with a discussions and applications of the concepts of demand & supply; theory of the consumer; theory of producer; and market structures. While in macroeconomics, the study involves the study of the economy as a whole, especially issues related to macroeconomic goals, national income account and its measurement, interest rates macroeconomic problems such as unemployment, deficit and inflation, growth and policy instruments.
4	Name(s) of Academic Staff:	Mengesha Yayo (Ph.D.), Dugassa Mulugeta (Ph.D.), Faris Ediris

5	Semester and Year offered:	Semester:	I	Year:	I	

6	Credit Hour:	3
7	Prerequisite/ Co-requisite: (if any)	None

8	Course Learning Outcome (CLO): At the end of the course, the student will be able to:	
	CLO1	Describe the major economic agents and their respective roles and objectives using diagrams
	CLO2	Analyze and apply the concepts of demand and supply and their interactions using concepts, tabular, graphical and mathematical methods
	CLO3	Analyze and apply the theory of consumer preferences and utility maximization approaches using concepts, tabular, graphical, and mathematical tools
	CLO4	Analyze and apply short- run behaviour of production and the related cost structure using concepts, tabular, graphical, and mathematical functions
	CLO5	Analyze and apply the different market structures and their real-world applications using concepts, graphical, diagrams, and mathematical functions
	CLO6	Describe and analyze macroeconomic goals, national income accounting, economic problems and policy instruments in light Ethiopian context.

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)													Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods	Test	Quiz	Assig	Proje	Lab-repo

														L	T	P	O					
	CLO1	√												√	√			√		√		
	CLO2		√											√	√			√	√	√		
	CLO3			√										√	√			√		√		
	CLO4					√								√	√			√	√	√		
	CLO5				√									√	√					√		
	CLO6							√						√	√					√		
	Indicate the relevancy between the CLO and PO by ticking “√”on the appropriate relevant box																					

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Develop a skill of formulating, and solving demand and supply function, elasticity coefficient, consumer utility optimization
	2	Develop a skill of constructing cost and production function, cost and production optimization of firms
	3	Develop a skill of computing total revenue, profit, breakeven point , shutdown points , cost and benefit of firms
	4	Develop a skill of analyzing and interpreting economic data and use scientific judgment to draw conclusions

11	Distribution of Student Learning Time (SLT)								
	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT) (hrs)
			Guided learning (F2F) (hrs)				Guided Learning (NF2F) (hrs)	Independent Learning (NF2F) (hrs)	
			L	T	P	O			
	Chapter 1: Introduction 1.1 Definition and Meaning of Economics 1.2 Rationale of Economics 1.3 Scope and methods of economic analysis 1.3.1 Micro and macroeconomics 1.3.2 Positive and normative economics 1.3.3 Inductive and deductive reasoning in economics. 1.4 Scarcity, choice, opportunity cost and production possibilities frontier 1.5 Basic economic questions 1.6 Economic systems 1.7 Decision making units and the circular flow model	1	6	2			1	3	12

	Chapter 2: Theory of Demand and Supply 2.1 Theory of Demand 2.1.1 Demand function, demand schedule and demand curve 2.1.2 Determinants of Demand 2.1.3 Elasticity of Demand 2.2 Theory of Supply 2.2.1 Supply function, supply schedule and supply curve 2.2.2 Determinants of supply 2.2.3 Elasticity of supply 2.2.4 Market equilibrium	1,2	8	5			1	5	19
	Chapter 3:Theory of Consumers' Behaviour 3.1 Consumer preferences 3.2 The concept of utility 3.3 Approaches of measuring Utility 3.3.1 The cardinal utility approach 3.3.1.1 Assumptions of cardinal utility theory 3.3.1.2 Total and marginal utility 3.3.1.3 Law of diminishing marginal utility (LDMU) 3.3.1.4 Equilibrium of the consumer 3.3.2 The ordinal utility approach 3.3.2.1 Assumptions of ordinal utility approach 3.3.2.2 Indifference curve and map 3.3.2.3 Properties of indifference curves 3.3.2.4 The marginal rate of substitution (MRS) 3.3.2.5 The budget line or the price line 3.3.2.6 Equilibrium of the consumer	3	8	4			1	7	20
	Chapter 4: Theory of Production and Costs 4.1 Theory of production in the short run 4.1.1 Definition of production 4.1.2 Production function 4.1.3 Total, average, marginal product 4.1.4 The law of variable proportions 4.1.5 Stages of production 4.2 Theory of costs in the short run 4.2.1 Definition and types of costs 4.2.2 Total, average, marginal costs in the short run 4.2.3 Relationship between short-run production and cost curves	3,4	7	4			1	5	17

	Chapter 5: Market structure 5.1 The concept of market in physical and digital space 5.2 Perfectly Competitive market 5.2.1 Assumptions 5.2.2 Short run equilibrium of the firm 5.2.3 Short run equilibrium of the industry 5.3 Monopoly market 5.3.1 Definition and Characteristics 5.3.2 Sources of Monopoly 5.4 Monopolistically competitive market 5.4.1 Definition and characteristics 5.5 Oligopolistic market 5.5.1 Definition and characteristics	3,4,5	5	4			1	5	15
	Chapter 6: : Fundamentals of macroeconomics (with stylized facts from Ethiopia) 6. Fundamentals of macroeconomics 6.1 Goals of Macroeconomics 6.2 The National Income Accounting 6.2.1 Approaches to measure national income (GDP) 6.2.2 Other income accounts (GNP, NNP, NI, PI and DI) 6.3 Nominal versus Real GDP 6.4 The GDP deflator and the Consumer Price Index(CPI) 6.5 The Business Cycle 6.6 Macroeconomic Problems 6.6.1 Unemployment 6.6.2 Inflation 6.6.3 Trade deficit and budget deficit 6.7 Macroeconomic Policy Instruments 6.7.1 Monetary policy 6.7.2 Fiscal policy	6	8	3			1	5	17
	Total		42	22			6	30	100

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F(hrs)	NF2F (hrs)	SLT(hrs)
1	Tests	25	3	2	5
2	Assignments	20	2	3	5
3	Quiz	5	0.5	1.5	2
				Total	12
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT

<table>
<tr><td></td><td>Final Exam</td><td>50</td><td>3</td><td>5</td><td>8</td></tr>
<tr><td></td><td colspan="4" align="right">Grand Total SLT</td><td>120</td></tr>
<tr><td></td><td colspan="5">L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.</td></tr>
<tr><td rowspan="2">12</td><td rowspan="2">Text book and reference:
(note: ensure the latest edition /publication)</td><td></td><td colspan="3">Text Book
1. Campbell R. McConnel, Economic Principles, Problems and Policies, 19th edition , publisher McGraw-Hill Higher Education, 2010</td></tr>
<tr><td></td><td colspan="3">Reference
1. A. Koutsoyiannis, Modern Microeconomics, 2nd edition (2003), 7th edition (2020)
2. R.S. Pindyck& D.L. Rubinfeld, Microeconomics. 8th edition (2013)
3. Dwivedi, D.N., Microeconomics: Theory and Applications, 3rd edition (2016)
4. Ayele Kuris, Introduction to Economics, 2001.
5. N. Gregory Mankiw, 2007, Macroeconomics, 4th edition (2007)</td></tr>
</table>

2.17.1.13 Global Trend

Addis Ababa Science and Technology University					
1	College: Natural and Social Science		Department: Social Science		
2	Course Category	Common Course	Stream: Engineering		
	Course Name	Global Trend			
	Course Code:	GLTr2001			
3	Synopsis:	The course aims to equip students with the basics of international relations, foreign policy and diplomacy, introduction to international political economy, globalization and regionalism, and major contemporary global trends.			
4	Name(s) of Academic Staffs:	Solomon G.			
5	Semester and Year offered:	Semester:	I	Year:	2
6	Credit Hour:	2			
7	Prerequisite	None			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to:				
	CLO1	Define the major theories of International Relations and develop the ability to critically evaluate and apply such theories for global issues.			
	CLO2	Explain foreign policy and diplomacy and evaluate the overriding foreign policy guidelines of Ethiopia in the past and present regimes.			
	CLO3	Explicate the nature, issues and elements of international political economy.			
	CLO4	Examine the major issues in globalization and regionalism in world politics.			
	CLO5	Analyze and evaluate the major contemporary global issues.			
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:				

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report

	CLO1						√							√				√	√			
	CLO2						√							√			√	√		√		
	CLO3							√						√				√				
	CLO4									√				√				√				
	CLO5											√		√			√			√		
	Indicate the relevancy between the CLO and PO by ticking “√”on the appropriate relevant box																					

10	Transferable Skills	
	1	Lifelong learning
	2	Problem diagnosis
	3	Individual and team work
	4	
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Understanding International Relations 1.1Conceptualizing Nationalism, Nations and States	CLO 1	6				1	7	14
1.2Understanding International Relations								
1.3 Levels of Analysis in International Relations								
1.4 The Structure of the International System								
1.5Theories of International Relations								
Chapter 2: Understanding Foreign Policy and Diplomacy 2.1 Defining National Interest	CLO 2	3				2	6	11
2.2 Understanding Foreign Policy and Foreign Policy Behaviors								
2.3. Overview of Foreign Policy of Ethiopia								
Chapter 3: International Political Economy 3.1 Meaning and Nature of International Political Economy								

(IPE) 3.2 Theoretical perspectives of International Political Economy 3.3 Survey of the Most Influential National Political Economy systems in the world 3.4. Core Issues, Governing institutions and Governance of International Political Economy 3.5. Exchange Rates and the Exchange-Rate System	CLO 3	8					10	18
Chapter 4: Globalization and Regionalism 4.1Defining Globalization 4.2The Globalization Debates 4.3 Globalization and Its Impacts on Africa 4.4Ethiopia in a Globalized World 4.5Pros and Cons of Globalization 4.6Defining Regionalism and Regional Integration 4.7. Major Theories of Regional Integrations	CLO 4	6				3	11	20
5. Major Contemporary Global Issues 5.1Survey of Major Contemporary Global Issues	CLO 5	2				2	3	7
	Total	25				8	37	70
Total								70

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	5%			
2	Test I	15%	½ hr	½ hr	1
3	Assignment I	10%		2	2
4	Test II	10%	½ hr	½ hr	1
5	Assignment II	10%		2	2

	Total			1	5	6
	Final Exam					
	Final Exam		50 (%)	2 hr	2 hr	4
	Total					10
	Grand Total					80
13	Reference	1	Balaam, David N., and Bradford Dillman. (2011). *Introduction to International Political Economy*. Boston: Longman.			
		2	Baylis, J. and Steve S. (2001). *The Globalization of World Politics: An Introduction to International Relations*. Oxford University Press: New York.			
		3	Payne, J.R. (2013).Global Issues: Politics, Economics, and Culture (4th eds.). Pearson Education, Inc.: Illinois State University.			
		4	Samuel P. Huntington, (1996). *The Clash of Civilizations and the Remaking of World Order*. New York: Simon and Schuster.			
		5	Steans, Jill, (1998). Gender and International Relations, Cambridge, Polity Press,			
	Text book (Module)		Ministry of Science and Higher Education (MoSHE) (2019). Global Affairs Common Course Teaching Module. Addis Ababa.			

2.17.1.14 History of Ethiopia and the Horn

Addis Ababa Science and Technology University						
1	College: Natural and Social Science			Department: Social Science		
2	Course Category	Common Course				
	Course Name	History of Ethiopia and the Horn				
	Course Code:	HiES2010				
3	Synopsis:	This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.				
4	Name(s) of Academic Staff:	Dagmawie Tesfaye (PhD)				
5	Semester and Year offered:	Semester:	II	Year:	1	
6	Credit Hour:	3				
7	Prerequisite/ Co-requisite: (if any)	None				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Identify the nature of history				
	CLO2	Identify pertinent sources for the history of the peoples of Ethiopia and the Horn				
	CLO3	describe changes and continuities in Ethiopia and the Horn .				
	CLO4	Discuss the causes, courses and consequences of events that happened in the region				
	CLO5	Explain the nature of the region's external contacts and their effects				
3	CLO 6	Appreciate peoples‟ achievements, heritages and cultural diversities of the region				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1									√				√				√		√		
CLO2		√				√									√						
CLO3		√											√					√	√		
CLO4				√															√		

	CLO5						√											√				
	CLO 6								√									√				
	Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box																					

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Develop a skill of critical analysis of sources.
	2	Demonstrate a skill of substantiation of arguments.
	3	Document a sources.

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: 1.1. The Nature and Uses of History	1	4	4				8	16
1.2 Sources and Methods of Historical Study								
1.3. The History of Historical Writing in Ethiopia and the Horn								
1.4. The Geographical Context of Human History in Ethiopia and the Horn0								
Chapter 2: Peoples and Cultures in Ethiopia and the Horn 2.1. Human Evolution	2	3	3				6	12
2.2. Neolithic Revolution								
2.3. The Peopling of the Region								
2.4. Religion and Religious Process								
Chapter 3: Polities, Economy and Socio-Cultural Processes in Ethiopia and the Horn to the End of the 13th Century 3.1. Evolution of State	3	4	4				8	16
3.2 Ancient Polities								
3.3. External Contacts								
3.4. Economic Formation								
3.5. Socio-cultural Achievement								
Chapter 4: Politics, Economy and Socio-Cultural Processes from the Late Thirteenth to the beginning of	4	3	4				7	14

	the Sixteenth Centuries 4.1 The "Restoration" of the "Solomonic'' Dynasty								
	4.2. Power Struggle, Consolidation, Territorial and Religious Expansion of the Christian Kingdom								
	4.3. Political and Socio-Economic Dynamics of Muslim Sultanates								
	4.4. Rivalry between the Christian Kingdom and the Muslim Sultanates								
	4.5. External Relations	5							
	Chapter 5: Politics, Economy and Socio-Cultural Processes from Early Sixteenth to the End of the Eighteenth Centuries		5	5				10	20
	5.1. Interaction and Conflicts between the Christian Kingdom and the Sultanate of Adal	6							
	5.2. Foreign Interventions and Religious Controversies								
	5.3. Population Movements								
	5.4. Interaction and Integration across Ethnic and Religious Diversities								
	5.5. Peoples and States in Eastern, Central, Southern and Western Region	4							
	5.6. The Period of Gondar (1636-1769) and Zemene-Mesafint / Era of the Princes (1769-1855)								
	Chapter 6. Internal Interactions and External Relations in Ethiopia and the Horn, 1800-1941	4	5	5				10	20
	6.1. The Nature of Interactions among Peoples and States of Ethiopia and the Horn								
	6.2. Power Rivalry								
	6.3. The Making of Modern Ethiopian State								
	6.4. Modernization Attempts	4							
	6.5. Socio-Economic Issues/Developments								
	6.6. Socio-Economic	5							

	Issues/Developments								
	Chapter. 7. Internal Developments and External Relations, 1941–1994		3	2				5	10
	7.1. Post-1941 Imperial Period	5							
	7.2. The Derg Regime (1974-1991)	6							
	Total		27	27				54	108

	Assessment					
	Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
	1	Tests	15%	1		1
	2	Assignments	10%	1		1
	3	Tests	10%	2		2
	4	Assignments	10%	1		1
	5	Quize	5%	1		1
					Total	12
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50%	2	4	6
					Grand Total SLT	120
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					

12	Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room …etc.)	1	Choose an item.
		2	Choose an item.
		3	Choose an item.
		4	Choose an item.
		5	Choose an item.
13	**Text book**		Ministry of Science and Higher Education History of Ethiopia and the Horn Module.

2.17.2 Core Courses

2.17.2.1 Emerging Technology for Engineers

Addis Ababa Science and Technology University					
1	College: Electrical and mechanical engineering		Department: Electrical and Computer Engineering		
	Course Name	Emerging Technology for Engineers			
	Course Code:	EmTe1108			
3	Synopsis:	This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.			
4	Name(s) of Academic Staff:	Mr. Yonas Tesfaye yonas.tesfaye@aastu.edu.et			
5	Semester and Year offered:	Semester:	II	Year:	1
6	Credit Hour:	3			
7	Prerequisite/ Co-requisite:	None			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Identify, explain, and differentiate all industrial revolutions			
	CLO2	Explain, identify and differentiate data science, artificial intelligence, internet of things and augmented reality			
	CLO3	Apply the big data, artificial intelligence, and internet of things concepts in different sectors			
	CLO4	Explain the advantages and disadvantages of emerging technologies such as big data, artificial intelligence, internet of things and augmented reality			
	CLO5	Explain and use ethics and professionalism in emerging technologies			
	CLO6	Explain and differentiate other emerging technologies such as nanotechnology, biotechnology, quantum computing, computer vision, cybersecurity, and 3D printing			
9	Mapping of the Course Learning Outcomes to the Program Learning Outcomes, Teaching Methods, and Assessment:				

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1		√															√				
CLO2		√															√		√		

	CLO3					√												√		√		
	CLO4	√																√		√		
	CLO5								√									√	√			
	CLO6						√													√		
	Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box																					

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities							Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)		
		L	T	P	O	X			
Chapter 1: Introduction to Emerging Technologies 1.1 Evolution ofTechnologies	CLO1	0.5							0.5
1.2 Role of Data for Emerging Technologies	CLO1	0.5	1						1.5
1.3 Enabling devices and network (Programmable devices)	CLO1	0.5							0.5
1.4 Human to Machine Interaction	CLO1	1	1						2
1.5 Future Trends in Emerging Technologies	CLO1	0.5							0.5
Chapter 2: Data Science 2.1 An Overview of Data Science	CLO2 CLO3 CLO4	0.5	1						1.5
2.2 Data types and their representation	CLO2 CLO3 CLO4	0.5	1						1.5
2.3 Data value Chain	CLO2 CLO3 CLO4	1	1						2
2.4 Basic concepts of big data	CLO2 CLO3 CLO4	1	2						3

	Chapter 3: Artificial Intelligence (AI) 3.1 What is Artificial Intelligence (AI)	CLO2 CLO3 CLO4	1	1				1	3
	3.2 History of AI	CLO2 CLO3 CLO4	0.5						0.5
	3.3 Levels of AI	CLO2 CLO3 CLO4	0.5	1				1	2.5
	3.4 Types of AI	CLO2 CLO3 CLO4	1	2		1	1	1	6
	3.5 Influencers of artificial intelligence	CLO2 CLO3 CLO4	0.5	1				1	2.5
	3.6 Applications of AI	CLO2 CLO3 CLO4	1	2				1	4
	3.7 AI tools and platforms	CLO2 CLO3 CLO4	1	2		1	1		5
	3.8 Some examples of AI application	CLO2 CLO3 CLO4	1	2		1	1		5
	Chapter 4: Internet of Things (IoT) 4.1 Overview of IoT	CLO2 CLO3 CLO4	1	1				1	3
	4.2 How does it work?	CLO2 CLO3 CLO4	1	2		1	1	1	6
	4.3 IoT Tools and Platforms	CLO2 CLO3 CLO4	1	2		1	1		5
	Chapter 5: Augmented Reality (AR) 5.1 Overview of augmented reality	CLO2 CLO3 CLO4	1					1	2
	5.2 Virtual reality (VR), Augmented	CLO2	1	2		1	1	1	6

Reality (AR) vs Mixed reality (MR)	CLO3 CLO4							
5.3 The architecture of AR Systems	CLO2 CLO3 CLO4	1	2		1	1		5
5.4 Applications of AR Systems	CLO2 CLO3 CLO4	1	1		1	1		4
Chapter 6: ETHICS AND PROFESSIONALISM OF EMERGING TECHNOLOGIES 6.1 Technology and ethics	CLO5	0.5						0.5
6.2 New ethical questions related emerging technology	CLO5	0.5						0.5
6.3 Digital privacy	CLO5	1	2					3
6.4 Accountability and trust	CLO5	0.5	1					1.5
6.5 Treats and challenges	CLO5	0.5	1					1.5
Chapter 7: Other emerging technologies 7.1 Nanotechnology	CLO6	1	1		1	1		4
7.2 Biotechnology	CLO6	0.5	1					1.5
7.3 Blockchain technology	CLO6	1	2					3
7.4 Cloud and quantum computing	CLO6	0.5	1		1	1		3.5
7.5 Autonomic computing (AC)	CLO6	0.5	1					1.5
7.6 Computer vision	CLO6	0.5	1		1	1		3.5
7.7 Embedded systems	CLO6	0.5	1					1.5
7.8 Cybersecurity	CLO6	1	1					2
7.9 Additive manufacturing (3D Printing)	CLO6	0.5	1		1	1		3.5
Total		28	42		12	12	9	103

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Lab/Demonstration	15	1	2	3
2	Test/quiz	15	1	2	3

	3	Assignement/Presentation	20	2	3	5
	4	Choose an item.				
	5	Choose an item.				
					Total	11
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50	2	4	6
					Grand Total SLT	
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					

12	Special requirements and resources to deliver the course	1	Different software simulation tools
		2	Computer lab
		5	Choose an item.
13	Textbook and reference:	1	Follett, J. (2014). Designing for Emerging Technologies: UX for Genomics, Robotics, and the Internet of Things: O'Reilly Media.
		2	Vong, J., and Song, I. (2014). Emerging Technologies for Emerging Markets: Springer Singapore.
		3	Del Rosal, V. (2015). Disruption: Emerging Technologies and the Future of Work. Emtechub.
		4	Sadiku, M. N. O. (2019). Emerging Internet-Based Technologies: CRC Press.
		5	Mohamed Anis Bach Tobji, Rim Jallouli, Yamen Koubaa, Anton Nijholt Digital Economy. Emerging Technologies and Business Innovation, 2018

2.17.2.2 Entrepreneurship for Engineers

Addis Ababa Science and Technology University						
1	College: Natural and Social Science			Department: Business and Management		
2	Course Category	Common Course				
	Course Name	Entrepreneurship for Engineers				
	Course Code:	Entr1106				
3	Synopsis:	This course is designed to encourage students to start their own business and to acquaint them with the peculiar challenges and management decisions faced by owners of small business. It will develop such entrepreneurial skills as: identifying business opportunities; initiating, financing, and developing new venture business plans. It also addresses issues of small business, such as: legal aspects, financing, costing, locating, personnel, marketing, competition, sources of funding, and constituency services.				
4	Name(s) of Academic Staff:					
5	Semester and Year offered:	Semester:	II	Year:	1	
6	Credit Hour:	2				
7	Prerequisite/ Co-requisite: (if any)	None				
8	Course Learning Outcome (CLO): At the end of the course, students will be able to:					
	CLO1	Explain about entrepreneurship				
	CLO2	Develop a business plan				
	CLO3	Explain the concept of business formation and small business				
	CLO4	Analyze about product/service development process				
	CLO5	Analyze marketing concept and marketing philosophy				
	CLO6	Evaluate business financing and business growth				

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1											√		√					√			
CLO2										√					√				√		
CLO3												√	√				√				
CLO4										√			√						√		
CLO5												√	√						√		

	CLO6											√	√							√		
	Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box																					

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Develop and communicate business plan.
	2	Develop marketing and financing skills.
	3	Develop skills of business formation

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT) (hrs)
		Guided learning (F2F) (hrs)				Guided Learning (NF2F) (hrs)	Independent Learning (NF2F) (hrs)	
		L		P	O			
Chapter 1: **The Nature Of Entrepreneurship** **1.1** Historical Origin of Entrepreneurship **1.2** Definition of Entrepreneurship and Entrepreneurs **1.3** Type of Entrepreneurs **1.4** Role of Entrepreneurs in Economic Development	1	4				1	4	9
Chapter 2: **Business Planning** 2.1 Opportunity Identification and Evaluation 2.2 Business Idea Development and Identification 2.3 Business Idea Screening 2.4 Developing Business Plan	2	4				1	3	8
Chapter 3: **Business Formation** 3.1 The Concept of Small Business 3.2 Establishing SMEs 3.3 Operating SMEs	3	4				1	3	8
Chapter 4: **Product and Service Development** 4.1 The Concept of Product/ Service Technology 4.2 Product/Service Development Process 4.3 Legal and Regulatory Framework for Entrepreneurs 4.4 Intellectual Property rights Protection	4	4				1	3	8
Chapter 5: **Marketing Strategy** 5.1 The Marketing Concept 5.2 Segmentation, Targeting and Positioning 5.3 The Marketing Mix Strategy	5	5				1	5	11

Chapter 6: **Business Financing** 6.1 Sources of Modern and Traditional SME Financing 6.2 Micro financing for SMEs 6.3 Crowd funding	6	4				1	4	9
Chapter 7: **Managing Growth and Transition** 7.1 Timmons Model of Entrepreneurship 7.2 New Venture Expansion Strategies 7.3 Business Ethics and Social Strategy	6	3				1	3	7
Total		28				7	25	60

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F(hrs)	NF2F (hrs)	SLT(hrs)
1	Tests	25	1.5	1.5	3
2	Assignments	20	2	4	6
3	Quiz	5	0.5	1.5	2
				Total	11

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	2	5	9
			Grand Total SLT	80

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face

Note: indicates the CLO based on the CLO's numbering in item 9.

12	Text book and reference: (note: ensure the latest edition /publication)	**Text Book** 2. Hisrich, R.D., Peters, M.P., Shepherd, D.A. (2011), Entrepreneurship, McGraw Hill International. **Reference** **1.** Justin G. Longenecker and Carlos W. Moore (2003) Small Business Management 12th edition, College Division South Western Publishing Co. Dallas **2.** Holt David H (2000) Entrepreneurship – New venture Creation, Eastern Economy Edition. **3.** Hodgetts, RichardM.Kurakto, Donald F(1998) Entrepreneurship: A contemporary approach. Fourth Edition, the Dryden Press, 1998. **4.** International Labor Organization (2015) Generate Your Business Idea. **5.** ILO (2006). "Stimulating Youth Entrepreneurship: Barriers and incentive to enterprise **6.** Kotler & Keller (2012) Marketing Management, 14th edition, Prentice Hall

2.17.2.3 Applied Mathematics IB

Addis Ababa Science and Technology University		
1	College: Natural and Social Science	Department: Mathematics
	Course Name	Applied Mathematics IB
	Course Code:	Math1014
3	Synopsis:	This course covers basic elements of vectors, vector spaces, matrices, determinants, solving systems of linear equations, concepts and applications of differential and integral calculus of one variable.
4	Name(s) of Academic Staff:	
5	Semester and Year offered:	Semester: II Year: 1
6	Credit Hour:	4
7	Prerequisite/ Co-requisite:	Mathematics for Natural Science (Math1007)
8	Course Learning Outcome (CLO): At the end of the course the student will be able to:	
	CLO1	Analyze the basic ideas of vector algebra and vector spaces
	CLO2	Analyze Matrix Theory
	CLO3	Describe the concepts of limit and continuity
	CLO4	Apply derivatives and its application.
	CLO5	Analyze definite, indefinite integrals and improper integral
	CLO6	Apply integration to solve real world problems

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods L	T	P	O	Assessment Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√	√			√		√		
CLO2	√												√	√			√		√		
CLO3	√												√	√			√		√		
CLO4		√											√	√			√		√		
CLO5	√												√	√			√		√		
CLO6		√											√	√				√			

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1	Skill of formulating, and solving broadly defined technical or scientific problems by applying knowledge of mathematics and science related to the content students are covering.
2	Skill of Applying thecourse knowledge tosolve complex engineering problems.
3	Skill of analyzing and interpreting mathematical data and use scientific judgment to draw conclusions

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F) (hrs)				Guided Learning (NF2F) (hrs)	Independent Learning (NF2F) (hrs)	Total (SLT) (hrs)
		L	T	P	O			

	Chapter 1:Vectors and vector spaces 1.1Scalars and Vectors; located and position vectors in R2 and R3 1.2Addition and scalar multiplication 1.3 Dot(Scalar) product, Magnitude of a vector , Angle between two vectors, Orthogonal projection,Direction angles and Direction cosines 1.4 Cross (Vector) product ; Triple products with Applications 1.5 Lines and planes in R3 1.6 Vector space; Subspaces 1.7 Linear Dependence and independence 1.8 Basis of a vector space	1	9	9			4	6	28
	Chapter 2:Matrices, Determinants and Systems of Linear Equations 2.1Definition of matrix and basic operations 2.2Product of matrices and some algebraic properties 2.3Elementary row operations and echelon forms 2.4 Rank of a matrix 2.5 Inverse of a matrix and its properties 2.6 Determinant of a matrix and its properties 2.7 System of linear equations; Cramer's rule; Gaussian's method; characterization of solutions 2.8 Eigen values and Eigenvectors	1,2	9	9			4	6	28
	Chapter 3:Limit and continuity 3.1Definition of limit 3.2Examples of limit of a function (linear, quadratic, rational with linear denominator) 3.3Basic limit theorems 3.4 One sided limits 3.5 Infinite limits, limit at infinity and asymptotes 3.6 Continuity of a function; one sided continuity; Intermediate value theorem		3	3			4	4	14
	Chapter 4:Derivatives and application of derivatives 4.1Definition, examples and properties of derivatives; basic rules; the chain rule 4.2Derivatives of inverse functions; Inverse trigonometric functions; Hyperbolic and inverse hyperbolic functions 4.3Implicit differentiation; higher order derivatives 4.4 Application of derivatives: Extrema of a function; Mean value theorem; first and second derivative tests; Concavity and inflection point ; Curve sketching 4.5 Indeterminate Forms (L'Hopital's Rule)	3,4	12	12			4	10	38

	Chapter 5:Integration 5.1Anti-derivatives; indefinite integrals 5.2 Techniques of integration 5.2.1Integration by substitution, by parts and by partial fraction 5.2.2 Trigonometric integrals 5.2.3 Integration by trigonometric substitution 5.3 Definite integrals; Fundamental Theorem of Calculus 5.4 Improper integrals 5.5Application of integrals; Area ; Volume of solid of revolution; Arc Length; Surface Area	3,4,5	9	9			5	5	28
	Total		42	42			21	31	136

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F(hrs)	NF2F (hrs)	SLT(hrs)
1	Tests	25	3	2	5
2	Assignments	20	4	4	8
3	Quiz	5	0.5	1.5	3
				Total	16

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	3	5	8
			Grand Total SLT	160

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Textbook and reference:	1	Text Book 1. Robert Ellis and Denny Gulick, Calculus with analytic geometry, 6th ed, Harcourt Brace Jovanovich, Publishers, 5th ed, 1993. 2. Demissu Gemeda: An introduction to Linear Algebra, 2000, Department of Mathematics, AAU 3. Serge Lang: Linear Algebra, 1974, Springer science +Business media Inc.
		 2 3 4	Reference Leithold, The calculus with analytic geometry, 3rd Edition, Herper and Row, publishers. Howard Anton: Calculus with analytic geometry, 2000, Anton Text Books, Inc. H. Anton and C. Rorres, Elementary Linear Algebra,1994, john Wiley and sons, Inc. James Stewart: Calculus, 2009, Thomson Brooks/ Cole

2.17.2.4 Engineering Drawing

Addis Ababa Science and Technology University		
1	College: Electrical and Mechanical Engineering	Department: Mechanical Engineering
	Course Name	Engineering Drawing
	Course Code:	MEng2101
3	Synopsis:	The course Engineering Drawing covers introduction and importance of engineering drawing, drawing instruments, drawing standards and conventions; theories of projection: types and systems of projections, projections of points and lines; multi-view drawings; pictorial drawing; auxiliary views and sectional view.
4	Name(s) of Academic Staff:	
5	Semester and Year offered:	Semester: I Year: 2
6	Credit Hour:	3 (1 Lecture, 1 Tutor and 5 Practical)
7	Prerequisite/ Co-requisite:	Nil
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Interpret and visualize engineering drawings, drawing conventions and standards
	CLO2	Draw projection of point, line, plane and solid
	CLO3	Construct multi-view drawings or supplement views from real objects or given pictorial drawings using appropriate engineering drawing tool and techniques.
	CLO4	Draw pictorial projections and drawing from real object or given multi-view drawings considering standard features
	CLO5	Function effectively as an individual and as group member in assignments and course activities.
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods L	T	P	O	Assessment Test	Quiz	Assignment	Project	Lab-report
CLO1										√			√	√			√	√	√		
CLO2					√								√	√			√	√	√		
CLO3					√								√	√			√	√	√		
CLO4					√								√	√				√	√		
CLO5									√										√		

10 Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1	
2	
3…etc.	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F) L	T	P	O	Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT)
1. Introduction to Engineering Drawing • History of	CLO1	2	1	5	-	1	2	11

	EngineeringDrawing • Objective of Engineering Drawing • Lettering • Drawing Instrument • Types of lines								
	2. Theory of Projection • Classifications of Projections • Projection of Point • Projection of a line (Normal, Inclined, Oblique)	CLO2 CLO5	2	2	8	-	2	2	13
	3. Multi-View Drawings • System of Projection • Choice of Views • One view, two view, and three view Drawings • Laying Out Drawings • Width, Height, and Depth relation ships • Projection of Planar and Non-Planar Surfaces • Projection of Fillets, Rounds and Run-outs • Projection of Solids (3D object) • Precedence of Lines	CLO3 CLO5	3	2	15	-	2	3	20
	4. Pictorial Drawing • Comparison between Multi view and Pictorial drawing • Types of Pictorial Projections • Isometric Drawings • Oblique Drawings	CLO4 CLO5	3	2	17	-	2	3	22
	5. Auxiliary Views • Primary Auxiliary Views • Secondary Auxiliary Views • Complete and partial Auxiliary Views	CLO3 CLO5	2	1	7	-	1	2	11
	6. Sectional View • Types of Sections • Making Sectional views • Conventional Representations • Sectional Auxiliary Views • Sectional in Pictorial Drawing (optional)	CLO3 CLO5	2	1	7	-	1	2	11
	Total		14	9	59		9	14	105

Assessment

	Continuous Assessment	Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	10	1	1	2
2	Tests	15	2	2	4
3	Assignments	25	-	-	-
4	Project	-	-	-	-
5	Lab Report	-	-	-	-

					Total	6
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50	3	6	9
					Grand Total SLT	**120**
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					
12	Special requirements and resources to deliver the course	1				
		2				
13	Textbook and reference:	1	Cecil Jensen and Jay D. Helsel, Engineering Drawing and Design, McGraw-Hill, New York, 7th Ed, 2008			
		2	Thomas French, Charles Vierck, and Robert Foster, Engineering Drawing and Graphics Technology, 1993			
		3	Warren J. Luzzader and Jon M. Duff, Fundamentals of engineering drawing, Prentice Hall, New Jersy, 11th ed, 1983.			
		4	R.S.Vaishwanar, Engineering Drawing and Graphics, Kumar Offset Press, New Delhi, 1993.			
		5	Voland, Gerard G.S., Modern Engineering Drawing and Graphics and Designs, West Publishing Company, 1987.			

2.17.2.5 Introduction to Computer Programming

	Addis Ababa Science and Technology University	
1	College: Electrical and mechanical engineering	Department: Electrical and computer engineering
	Course Name	**Introduction to Computer Programming**
	Course Code:	Comp2003
3	Synopsis:	This course, after a brief introduction of what programming languages are and their classifications extends fundamental programming principles and concepts. It specifically deals with variables and constants; scope; operators and operator precedence; comment statements; input and output statements; control structures and arrays; functions and pointers; and structures and files.
4	Name(s) of Academic Staff:	Yonas Tesfaye Yonas.tesfaye@aastu.edu.et
5	Semester and Year offered:	Semester: II; Year: 2
6	Credit Hour:	3
7	Prerequisite/ Co-requisite:	None
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Apply basics of programming constructs
	CLO2	Differentiate and apply the control structures of C++ programming
	CLO3	Differentiate and apply the compound data types in C++ programming
	CLO4	Apply the OOP concept in C++ programming
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignme	Project	Lab-report
CLO1	✓												✓		✓		✓		✓	✓	
CLO2		✓											✓	✓	✓		✓		✓	✓	
CLO3		✓											✓	✓	✓		✓		✓	✓	
CLO4			✓										✓	✓	✓		✓			✓	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)
11	Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT)
		L	T	P	O			
Chapter 1: Basics of C++ 1.1 Structure of a program	CLO1	1		1		✓	2	4
1.2 Constants	CLO1	1		1		✓	2	4
1.3 Operators	CLO1	1		1		✓	2	4
1.4 Basic input/output	CLO1	1		1		✓	2	4

	Chapter 2: Control structure 2.1 Control structures ➢ Conditional structure ➢ Iteration structure (Loops) ➢ Jump statement ➢ Selective structure	CLO2	3	1	3		✓	2	9
	2.2Functions	CLO2	2	1	2		✓	2	7
	2.3 Arguments passed by value and by reference	CLO2	2	1	1		✓	2	6
	Chapter 3: Compound data types 3.1Arrays	CLO3	2	1	2		✓	2	7
	3.2 Character sequence	CLO3	2	1	1		✓	2	6
	3.3 Pointers	CLO3	3	2	3		✓		8
	3.4 Dynamic memory	CLO3	3	2	3		✓		8
	3.5 Data structures	CLO3	3	3	3		✓		9
	3.6 Other data types	CLO3	3	1	2		✓		6
	Chapter 4: Object oriented programming 4.1 Classes I	CLO4	3	1	3		✓		7
	4.2 Constructors and destructors	CLO4	2	1	2		✓		5
	4.3 Overloading constructors	CLO4	1	1	1		✓		3
	4.4 Default constructor	CLO4	1		1		✓		2
	4.5 Pointer to classes	CLO4	3	2	3		✓		8
	4.6 Classes defined with struct and union	CLO4	3	2	3		✓		8
	Total								115

Assessment2

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test	20	1		1
2	Assignment	20			
3	Project	30			
4	Choose an item.				
5	Choose an item.				
				Total	1
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		30	3	1	4
				Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software like turbo C++, Dev C++
		2	Computer lab
		3	Choose an item.
13	Textbook and reference:	1	C++ language tutorial http://www.cplusplus.com/doc/tutorial/
		2	Ravichandran; " Problem Solving with C++", Tata Mc. Graw Hill Company.
		3	Robert Lafore, Object Oriented Programming with C++.
		4	**C++ Pocket Reference 1st Edition** by Kyle Loudon, 2003, ISBN-10 : 0596004966, ISBN-13 : 978-0596004965
		5	**C++ Primer (5th Edition) 5th Edition** by Stanley Lippman, Josée

			Lajoie, Barbara Moo 2012, ISBN-10 : 9780321714114, ISBN-13 : 978-0321714114
		6	**C++: The Complete Reference, 4th Edition 4th Edition** by Herbert Schildt 2002, ISBN-10 : 0072226803, ISBN-13 : 978-0072226805

2.17.2.6 Engineering Mechanics I (Statics)

	Addis Ababa Science and Technology University					
1	College: Architecture and Civil Engineering			Department: Civil Engineering		
	Course Name	Engineering Mechanics-I (Statics)				
	Course Code:	CEng2103				
3	Synopsis:	Engineering mechanics (Statics) is the application of mechanics (one of the three branches of Physics) to solve problems involving common engineering elements				
4	Name(s) of Academic Staff:	Yohannes Gudeta				
5	Semester and Year offered:	Semester:	I	Year:	2	
6	Credit Hour:	3				
7	Prerequisite/ Co-requisite:	General Physics (Phys-1001)				
8	***Course Learning Outcome (CLO): At the end of the course the student will be able to do:***					
	CLO1	Apply the basic principles of Mechanics (Statics) and apply them to real-world life problems or to new situations. Understand how physical bodies interact with their surroundings, distinguish concurrent, coplanar and space forces, Compute the resultant of coplanar and space force systems. And attain a state of equilibrium.				
	CLO2	Apply the principles of force systems and analyze the internal reactions and external forces induced in coplanar and space systems using equilibrium equations.				
	CLO3	Determine an equivalent resultant force for a given different forces acting on one object. Determine centroids and center of mass of plane areas and volumes and know section properties of members of a structure which are measures of resistance to a given force.				
	CLO4	Draw shear force and bending moment diagrams of beam structures.				
	CLO5	Determine static friction forces and their influence up on equilibrium of systems.				
	CLO6	Demonstrate familiarity with structural analysis of trusses, frames and beams and application of mechanics to Engineering problems				
9	**Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:**					

	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
Course Learning Outcomes (CLO)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	L	T	P	O	Test	Quiz	Assignme	Project	Lab-report
CLO1	√												√	√			√		√		
CLO2		√											√	√			√		√		
CLO3		√											√	√			√		√		
CLO4			√										√	√				√	√	√	
CLO5	√												√	√				√	√		
CLO6			√										√	√				√	√		

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Design of Structural components
	2	Checking the stability of structures
	3 etc	Preparing Shear force and bending moment diagrams to provide compression and tension reinforcements

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Scalars and Vector 1.1 Introduction	1	1						1
1.2 Scalars and Vectors	1	1	1				1	3
1.3 Operation with Vectors	1	1	1				1	3
1.3.1 Vector Addition or Composition 1.3.2 Vector Multiplication: Dot and Cross	1	2	3				1	6
Chapter 2: Force Systems 2.1ntroduction	1,2	1						1
I. Two-Dimensional Force Systems	1,2	1	2			1	1	5
2.2 Rectangular Resolution of Forces	1,2	1	2			1	1	5
2.3 Moment and Couple	1,2	1	2			1	1	5
2.4 2.4 Resultants of general coplanar force systems	1,2	1	2			1	1	5
II. Three-Dimensional Force Systems	1,2							
2.5 Rectangular Components	1,2	1	2			1	1	5
2.6 Moment and Couple	1,2	1	2			1	1	5
Chapter 3: Equilibrium 3.1 Introduction	1,2,3	1						1
I. Equilibrium in Two Dimensions	1,2,3							
3.2 System Isolation	1,2,3	1	1			1	1	4
3.3 Equilibrium Conditions	1,2,3	1	1			1	1	4
II. Equilibrium in Three Dimensions	1,2,3							
3.4 System Isolation	1,2,3	1	1					2
3.5 Equilibrium Conditions	1,2,3	1	1					2
Chapter 4: Analysis of simple Structure 4.1 Introduction	1,2,6	1						1
4.2 Plane Trusses 4.2.1 Method of Joints 4.2.2 Method of Sections	1,2,6	1	2			1	1	5
4.3 Frames and Simple Machines	1,2,6	1	1				1	3
Chapter 5: Internal Actions in beams 5.1 Introduction	4	1	1					2
5.2 Diagrammatic conventions and classification of beams	4	1					1	2

	5.3 Diagrammatic representations of internal actions in beams	4	1						1
	5.4 Types of loads and reactions	4	1					1	2
	5.5 Shear force and bending moment in beams	4	1				1	1	3
	5.6 Relation between the static functions and their applications Relations among load, shear, and bending moments	4	1				1	1	3
	Chapter 6: Centroids								
	6.1 Introduction,	1,2,3	1						1
	6.2 Center of gravity	1,2,3	1	1					2
	6.3 Centroids of lines, Areas, and Volumes	1,2,3	1	1			1	1	4
	6.4 Centroids of composite bodies	1,2,3	1	1			1	1	4
	6.5 Determination of centroid by integrations	1,2,3	1	1			1	1	4
	6.6 Distributed loads in beams	1,2,3	1	2					3
	Chapter 7: Area Moments of Inertia								
	7.1 Introduction to area moments of inertia	1,2,3,4,5,6	1	2					3
	7.2 Moment of inertia of plane areas and curves	1,2,3,4,5,6	1	2			1	1	5
	7.3 Moments of inertia of Composite areas	1,2,3,4,5,6	1	2			1	1	5
	7.4 Products of Inertia and Rotation of Axes	1,2,3,4,5,6	1	2					3
	Chapter 8: Friction								
	8.1 Introduction	5	1						1
	8.2 Types of Friction	5	1						1
	8.3 Characteristics of dry friction	5	1						1
	8.4 Application of Friction in Machines	5	1	1			1	1	4
	Total		40	40			17	23	**120**

Assessment

Continuous Assessment		**Percentage Total-50(%)**	**F2F**	**NF2F**	**SLT**
1	Tests	10%	√		1
2	Quiz	10%	√		1
3	Assignments	20%		√	3
4	Project	10%	√	√	2
5	Others				
				Total	**7**

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50%	√		3
			Grand Total SLT	**130**

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special	1	Choose an item.

	requirements and resources to deliver the course	2	Choose an item.
		3	Choose an item.
13	Textbook and reference:	1	Meriam, J.L. and Kraige, L.G., Engineering mechanics (Statics), 7th ed.
		2	Meriam, J.L. and Kraige, L.G., Engineering mechanics, 6th ed.
		3	Engineering Mechanics: Statics and Dynamics by Anthony M. Bedford, Wallace Fowler, Prentice Hall; 5 edition (July 2007)
		4	Engineering Mechanics: Statics by Russell C. Hibbeler, Prentice Hall; 12 edition (January 7, 2009)
		5	Schaum's Outline of Engineering Mechanics by E. W. Nelson, Charles L. Best, William G. McLean, McGraw-Hill; 5 edition (May 1997)

2.17.2.7 Engineering Mechanics II (Dynamics)

Addis Ababa Science and Technology University						
1	College: Electrical and Mechanical Engineering			Department: Mechanical Engineering		
2	Course Name	Engineering Mechanics II (Dynamics)				
	Course Code	Meng2102				
3	Synopsis:	Basic equations of motion; Kinematics of particles and rigid bodies; Kinetics of particles and rigid bodies				
4	Name(s) of Academic Staff:					
5	Semester and Year offered:	Semester:	II	Year:	2	
6	Credit Hour:	3				
7	Prerequisite/ Co-requisite:	CEng2103: Engineering Mechanics I (Statics) Math1014: Applied Mathematics-IB				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Understand and apply basic principles that govern the motion of objects.				
	CLO2	Develop appropriate mathematical models that represent physical systems.				
	CLO3	Select appropriate coordinate systems for physical systems and analyze motion variables such as position, velocity, and acceleration.				
	CLO4	Derive equations of motion that relate forces acting on systems and the resulting motion.				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignmen	Project	Lab-report
CLO1	√												√	√			√	√	√		

10	CLO2			√										√	√			√		√		
	CLO3				√									√	√			√		√		
	CLO4		√										√	√	√			√		√		

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	

11	Distribution of Student Learning Time (SLT)								
	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	1. Introduction 1.1. Basic concepts; 1.2. Equations of motion; 1.3. Gravitation 1.4. Solving problems in Dynamics	CLO 1 CLO 2	2	3	-	-	2	3	10
	2. Kinematics of particles 2.1. Rectilinear motion 2.2. Plane curvilinear motion; Coordinate systems (rectangular, normal-tangential, polar) 2.3. Relative motion 2.4. Constrained motion	CLO 1	8	12	-	-	3	8	31
	3. Kinetics of Particles 3.1 Newton's Second law of motion 3.2 Work-Energy Equations 3.3 Impulse and momentum 3.4 Impact	CLO 1 CLO 3 CLO 4	6	9	-	-	2	6	23
	4. Kinematics of rigid bodies 4.1 Types of Rigid body motion 4.2 Fixed axis rotation 4.3 Absolute motion **4.4** Relative motion	CLO 1 CLO 2 CLO 3 CLO 4	6	8	-	-	2	5	21

	5. Kinetics of rigid bodies 5.1 General equation of motion 5.2 Work and energy method 5.3 Impulse and momentum	CLO 1 CLO 2	4	6	-	-	2	4	16
	Total		**26**	**38**			**11**	**26**	**101**

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	5	1	-	1
2	Tests	30	2	-	2
3	Assignments	15	-	7	7
4	Project	-	-	-	-
5	Seminar	-	-	-	-
Total					**10**
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	3	6	**9**
Grand Total SLT (26+38+11 +26+10+9)					**120**

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	
		2	Choose an item.
		3	Choose an item.
13	Textbook and reference:	1	Meriam J.L., Engineering Mechanics - Dynamics, 6th ed., 2003.
		2	Hibbeler, Rusel M., Engineering Mechanics: Dynamics,10th ed., 2003
		3	Beer, Johnston, Clausen,Eisenberg, Cornwell, Vector Mechanics for Engineers: Dynamics, 9th ed., 2004.

2.17.2.8 Applied Mathematics IIB

Addis Ababa Science and Technology University		
1	College: Natural and Social Science	Department: Mathematics
	Course Name	Applied Mathematics IIB
	Course Code:	Math(2007)
3	Synopsis:	This course covers basic elements of sequence and series, power series, differential calculus of several variables and multiple integral concepts and their applications.
4	Name(s) of Academic Staff:	
5	Semester and Year offered:	Semester: I Year: 2
6	Credit Hour:	4
7	Prerequisite/ Co-requisite:	Applied Mathematics IB (Math1014)
8	Course Learning Outcome (CLO): At the end of the course the student will be able to :	
	CLO1	analyze the concepts of differential calculus of functions of several variables
	CLO2	describe the main concept of multiple integrals
	CLO3	analyze the basic ideas of sequence and series
	CLO4	describe the basic concept of power series
	CLO5	analyze the basic concept of Fourier series and Orthogonal Functions
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√	√			√		√		
CLO2	√												√	√			√		√		
CLO3	√												√	√			√		√		
CLO4		√											√	√			√		√		
CLO5	√												√	√				√			

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)
1	Skill of applying the content concept to solve complex engineering problems
2	Skill of applying the lesson content in any researches involving mathematical concepts

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			

	Chapter1:Differential calculus of function of several variables 1.1Notations, examples, level curves and graphs 1.2 Limit and continuity 1.3 Partial derivatives; tangent lines, higher order partial derivatives. 1.4 Directional derivatives and gradients 1.5 Total differential and tangent planes 1.6 Applications: tangent plane approximation of values of a function 1.7 The chain rule, implicit differentiation 1.8 Relative extrema of functions of two variables 1.9 Largest and smallest values of a function on a given set 1.10 Extreme values under constraint conditions: Lagrange’s multiplier	1	12	12			4	8	36
	Chapter 2:Multiple integrals 2.1 Double integrals and their evaluation by iterated integrals 2.2 Double integrals in polar coordinates 2.3 Application: Area, center of mass of plane region, surface area. 2.3 Triple integrals in cylindrical and spherical coordinates 2.4 Application: Volume, center of mass of solid region	1,2	9	9			5	7	30
	Chapter 3:Sequence and series 3.1Definition and types of sequence 3.2 Convergence properties of sequences 3.3 Subsequence and limit points 3.4 Definition of infinite series 3.5 Convergence and divergence, properties of convergent series 3.6 Nonnegative term series 3.7 Tests of convergence (integral, comparison, ratio and root tests) 3.8 Alternating series and alternating series test 3.9 Absolute and conditional convergence 3.10 Generalized convergence tests	3	9	9			2	6	26
	Chapter 4:Power series 4.1 Definition of power series at any x_0 and $x_0 = 0$ 4.2 Convergence and divergence, radius and interval of convergence 4.3 Algebraic operations on convergent power series 4.4 Differentiation and integration of power series 4.5 Taylor series; Taylor polynomial and application	3,4	3	3			2	6	14
	Chapter 5:Fourier series and Orthogonal Functions 5.1 Orthogonal functions 5.2 Fourier series 5.2.1 Fourier series of functions with period 5.2.2 Fourier series of functions with arbitrary period 5.2.3 Fourier series of odd and even functions 5.3 Fourier integrals	3, 5	9	9			3	7	28
	Total		42	42			16	34	134

Assessment

Continuous Assessment	Percentage Total-50(%)	F2F	NF2F	SLT

	1	Tests	25	2	2	4
	2	Assignments	20	5	5	10
	3	Quize	5	1	2	3
					Total	17
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50	3	6	9
					Grand Total SLT	160
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					

12	Textbook and reference:	1	Textbooks: Robert Ellis and Denny Gulick, Calculus with analytic geometry, 6th ed, Harcourt Brace Jovanovich, Publishers, 5th ed, 1993.
		2	References: 1.Leithold, The calculus with analytic geometry, 3rd Edition, Herper and Row, publishers. 2.R. T. Smith and R. B. Minton, Calculus concepts and connections, McGram-Hill book company, 2006 3. D. V. Widder, Advanced calculus, Prentice-Hall, 1979 4. Ross L. Finney et al, Calculus, Addison Wesley, 1995 5. E. J. Purcell and D. Varberg, Calculus with analytic geometry, Prentice-Hall INC., 1987 6. R. Wrede and M. R. Spiegel, Theory of advanced calculus, 2nd ed., McGraw-Hill, 2002. 7. A. E. Taylor and W. R. Mann, Advanced calculus, 3rd ed, John-Wiley and Son, INC, 1995

2.17.2.9 Applied Engineering Mathematics IIIB

	Addis Ababa Science and Technology University		
1	College: Natural and social sciences		Department: Mathematics
	Course Name	Applied Mathematics IIIB	
	Course Code:	Math2042	
3	Synopsis:	This course covers basic elements of ordinary differential equations, Laplace and Fourier transforms, vector differential calculus, Line and surface integral and complex analytic functions	
4	Name(s) of Academic Staff:		
5	Semester and Year offered:	Semester: **II**	Year: **2**
6	Credit Hour:	**4**	
7	Prerequisite/ Co-requisite:	Applied Mathematics IIB (Math2007)	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Identify basic solution techniques to solve ordinary differential equations of first order.	
	CLO2	Identify basic solution techniques to solve ordinary differential equations of second order.	
	CLO3	Analyze the concept of Laplace and Fourier transforms.	
	CLO4	Analyze vector differential calculus.	
	CLO5	Analyze line and surface integral	
	CLO6	Analyze complex analytic functions.	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assign ment	Project	Lab-
CLO1	√												√	√			√		√		
CLO2	√												√	√			√		√		
CLO3	√												√	√			√		√		
CLO4		√											√	√			√		√		
CLO5		√											√	√				√	√		
CLO6	√												√	√							

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Ordinary Differential Equation of the First Order a. Basic Concepts and ideas b. Separable Equations	1	8	8				8	24

	c. Equations Reducible to Separable Form d. Exact Differential Equation e. Integrating Factors f. Linear first order differential equations								
	Chapter 2: Ordinary Differential Equation of the Second Order 2.1 Homogeneous equations with constant coefficients 2.1.1. General solutions, basis, initial value problems 2.1.2. Real roots, complex roots, double roots of the characteristic equation 2.2. Non-Homogeneous equations with constant coefficients 2.2.1. The Method of undetermined coefficients 2.2.2. Variation Parameters 2.2.3. System of Ordinary Differential Equations of the First Order 2.3 Linear ODE of Higher Order; System of ODE OF Higher Order.	1, 2	5	5				7	17
	Chapter 3: Laplace and Fourier Transformations 3.1 Laplace Transform 3.2 Differentiation of Laplace Transform 3.3 Integration of Laplace Transform 3.4 Convolution and Integral Equation 3.5. Fourier Transform	3	6	5				7	18
	Chapter 4: Vector Differential Calculus 4.1 Vector Calculus (Limit, Derivative and Integral of Vector Valued Functions) 4.2 Curves and Their Lengths 4.3 Tangent, Curvature and Torsion 4.4. Scalar and Vector Fields 4.5. Gradients of Scalar fields 4.6. Divergence and Curl of Vector Field	4	5	5				7	17
	Chapter 5: Line and Surface Integral 5.1 Line Integral 5.2 The Fundamental Theorem of Line Integrals and Independent of Path 5.3 Green’s Theorem 5.4. Surface Integral 5.5. Divergence’s Theorem and Stoke’s Theorem	4, 5	9	8				8	25
	Chapter 6: Complex Analytic Functions 6.1. Complex Numbers; Complex Plane 6.2. Functions of Complex Variables: Limits, Derivatives and Analytic Functions 6.3. Cauchy-Riemann Equations; Laplace Equation 6.4. Elementary Functions: Exponential, Trigonometric, Hyperbolic, and Logarithmic Functions, Power functions 6.5. Complex Integral	6	6	6				8	20

Total		39	37				47	123

Assessment

Continuous Assessment		CLO	Percentage Total-50(%)	F2F	NF2F	SLT
1	**Test I**	1,2	15%	1	5	6
2	**Assignment I**	1,2,3	10%	0	3	3
3	**Test II**	3,4	10%	1	4	5
4	**Assignment II**	3,4,5	10%	0	3	3
5	**Quiz**	5	5%	0.5	0.5	1
					Total	18

Final Exam	CLO	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	1,2,3,4,5,6	50%	3	16	19
				Grand Total SLT	160

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Choose an item.
		2	Choose an item.
13	Textbook and reference:	1	Erwin Kreyzig, Advanced Engineering Mathematics
		2	J. Stewart , Calculus 6th edition
		3	R. Ellis, Calculus with Analytic Geometry
		4	R.V. Churchill, Complex Variables and Application.

2.17.2.9 Engineering Thermodynamics

Addis Ababa Science and Technology University						
1	College: Electrical and Mechanical Engineering			Department: Mechanical Engineering		
2	Course Category	Common Course		Course Code:MEng2105		
	Course Name	Engineering Thermodynamics				
3	Synopsis:	Fundamental concepts; Pure substances; Vapor pressure curves; Steam tables; Phase diagrams of steam; First law of Thermodynamics: closed and open systems, enthalpy; Second law of Thermodynamics: Reversible and irreversible processes; Carnot cycle; Entropy; Ideal gases and their mixtures; gas-steam mixtures; wet air; psychometric charts and air conditioning process; Vapor power and refrigeration cycles; Air standard cycles;				
4	Name(s) of Academic Staff:	Misrak Girma (PhD)				
5	Semester and Year offered:	Semester:	Choose an item.	Year:	Choose an item.	
6	Credit Hour:	3				
7	Prerequisite/ Co-requisite:	Applied Mathematics I (Math-1051)				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Apply Zeroth law of thermodynamics to formulate temperature scales and relationship between internal energy, heat and work.				
	CLO2	Apply the first law of thermodynamics to calculate the property changes in a systems				
	CLO3	Explain the basics of pure substances and state the second law of thermodynamics and its application				
	CLO4	Explain the basic concept of entropy				
	CLO5	Explain the basics of gas power cycle, vapor power cycle and Refrigeration cycles				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes	Program Learning Outcomes (PO)												Teaching Methods				Assessment			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assign	Lab-report
CLO1		√											√	√				√	√	
CLO2		√											√	√			√		√	
CLO3	√												√	√					√	
CLO4	√												√	√					√	
CLO5	√												√	√					√	

Indicate the relevancy between the CLO and PO by ticking “√”on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc	
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			

	Chapter 1: **Basic Concept and Definition** Thermodynamics and Energy, Note on dimensions and units, Closed and open systems, Forms of energy, Properties of system, State and equilibrium, Process and cycles, Pressure, Temperature and the zeroth law of thermodynamics	CLO1	4	3			1	5	13
	Chapter 2: **First Law of Thermodynamics and Energy** Introduction to the first law, Definition of heat, Heat transfer modes, Work, Mechanical forms of work, The first law of thermodynamics, Specific heats, Internal energy, enthalpy, and specific heats of ideal gases, solids, and liquids, The first law of thermodynamics for control volume	CLO2	4	6			1	7	18
	Chapter 3: **Properties of pure substance** Pure substance, Phases of a pure substance, Phase-change processes of pure substance, Property diagrams for phase-change processes, Vapor pressure and phase equilibrium, Property tables, The ideal gas equation of state, Compressibility factor- a measure of deviation from ideal gas behavior	CLO3	4	3			1	7	15
	Chapter 4: **Second Law of Thermodynamics** Introduction to the second law of thermodynamics, Thermal energy reservoirs, Heat engines, Refrigerators and heat pumps, The Carnot cycle, The Carnot principles, The Carnot heat engine, The Carnot refrigerator and heat pump,	CLO3	4	3			1	6	14
	Chapter 5: Entropy Entropy and the clausius inequality; Definition of entropy; The increase of entropy principle, Entropy change of pure substance, Entropy change of liquids, solids, and ideal gases,	CLO4	4	3			1	6	14

	Chapter 6: Gas Power Cycles Carnot cycle; Otto cycle: the ideal cycle for spark ignition engines; Air standard diesel cycle; Brayton cycle; Regenerative brayton cycle	CLO5	2	3			1	5	11
	Chapter 7: Vapor Power Cycle Carnot cycle; Rankine cycle; The ideal reheat cycle; Regenerative cycle; Deviation from real cycles	CLO5	2	3			1	5	11
	Chapter 8: Refrigeration Cycles Refrigeration and heat pump; Refrigerant; Reversed Carnot refrigerator and heat pump; The vapor- compression refrigeration cycle; Real vapor- compression refrigeration cycle	CLO5	2	3			1	5	11
	Total								107

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	5%	1	-	1
2	Tests	20%	2	1	3
3	Assignments	25%	-		
				Total	4
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam			3	6	9
				Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Choose an item.
		2	Choose an item.
		3	Choose an item.
13	Textbook and reference:	1	Cengel Y A.,Bole M A., Thermodynamics – An Engineering Approach, Sep 22, 2006.(Textbook)
		2	Sonntag R.E.," Fundamentals of Thermodynamics", Sept 13, 2004
		3	Moran, Michael J. "Fundamentals of Engineering Thermodynamics", 5th ed., 2003.
		4	P.k.Nag. "Engineering Thermodynamics", - Tata McGraw Hill Publications, 2007

2.17.2.11 Fundamentals of Electrical Engineering

Addis Ababa Science and Technology University						
1	College: Electrical and Mechanical Engineering			Department: Electrical Engineering		
2	Course Category	Core Course		Course Code: ECEg2102		
	Course Name	Fundamentals of Electrical Engineering				
3	Synopsis:	In this course we discuss about: Review of Electromagnetic Phenomenon and Variables, Electric Circuit parameters, Circuit Analysis, SteadyState Single Phase AC Circuit Analysis, Transient Circuit Analysis, Introduction to poly phase systems.				
4	Name(s) of Academic Staff:					
5	Semester and Year offered:	Semester:	II	Year:	2	
6	Credit Hour:	4				
7	Prerequisite/ Co-requisite:	Math-1014: Applied Mathematics IB for Engineering				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Describe basic electric circuit parameters and apply basic laws in simple circuit analysis				
	CLO2	Solve problems involving DC networks and steady state AC circuits by applying various laws and theorems				
	CLO3	Examine and analyze the concept of Transients in electric circuit analysis				
	CLO4	Optimize the efficiency of a system by selecting the best power factor corrector				
	CLO5	Analyze balanced and unbalanced three-phase AC circuits, interpret relationship between voltage, current and power				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assign ment	Project	Lab-report
CLO1	√												√	√	√		√	√	√		√
CLO2	√												√	√	√		√	√	√		√
CLO3	√	√											√	√	√		√		√		√
CLO4		√		√									√	√	√			√	√		√
CLO5		√		√									√	√	√		√		√		√

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Select proper sets of measuring instruments and to measure characteristics of electrical systems.
	2	Calculate electrical parameters and test this in different electrical operating conditions.
	3	Perform simple circuit design
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			

	Chapter 1: Basic Concepts 1.1. Systems of Units 1.2. Charge & Current 1.3. Voltage 1.4. Power & Energy 1.5. Circuit Elements	1	2	3	3		1	2	8
	Chapter 2: Basic Laws 2.1. Ohm's Law 2.2. Nodes, Branches & Loops 2.3. Kirchhoff's Laws 2.4. Volage & Current Division 2.5. Star(Y)-Delta (Δ) Transformation	1,2	4	6	6		1	4	15
	Chapter 3: DC Circuit Analysis and Circuit Theorems 3.1: Nodal Analysis 3.2. Mesh Analysis 3.3. Linearity & Superposition 3.4. Source Transformation 3.5. Thevenin's & Norton's Theorems 3.6. Maximum Power Transfer.	1,2	6	9	9		1	6	22
	Chapter 4: Steady State Single Phase AC Circuit Analysis 4.0. Capacitors & Inductors 4.1 Sinusoids & Phasors 4.2. Phasor Relationships for Circuit Elements 4.3. Impedance & Admittance 4.4. Node and Mesh analysis in AC circuits 4.5. Instantaneous & Average power 4.6. Effective & RMS value 4.7. Active (average), reactive and apparent powers 4.8. Power factor & power factor correction	2,4	6	9	9		1	6	22
	Chapter 5: Transient Circuit Analysis 5.1. First Order Transient Circuits 5.2. Second Order Transient Circuits 5.3. Higher Order Circuits and Approximations	2,3	4	6	6		1	4	15
	Chapter 6: Introduction to Polyphase Systems 6.1. Generation of three phase voltages 6.2 Balanced Three-Phase voltages 6.3. Star (Y) and Delta (Δ) connections 6.4. Unbalanced Three-Phase	5	4	6	6		1	4	15

	Systems 6.5. Power in Unbalanced System								
	Total		26	39	39		6	28	138

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	15	√		3
2	Quiz	5	√		1
3	Assignments	15		√	6
4	Lab-report	10		√	6
				Total	16
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	√		3
				Grand Total SLT	157

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Laboratory — Fundamentals of Electrical Engineering Lab
		2	Software — NI Multisim
		3	Computer Lab
13	Textbook		Charles K. Alexander & Matthew N. O. Sadiku***, Fundamentals of Electric Circuits***, McGraw-Hill Education, 6th/7th ed, 2018/21
	Reference	1	J.David Irwin & R. Mark Nelms ,***Basic Engineering Circuit Analysis****,* 11th ed., 2018
		2	W. H. Hayt and, J.E. Kemmerly & S.M. Durbin, ***Engineering Circuit Analysis***, 8th ed. ,2012

2.17.2.12 Probability and Random Process

Addis Ababa Science and Technology University					
1	College: Electrical and Mechanical Engineering	Department: Electrical and Computer Engineering			
	Course Name	Probability and Random Process			
	Course Code:	ECEg2110			
3	Synopsis:				
4	Name(s) of Academic Staff:				
5	Semester and Year offered:	Semester:	II	Year:	II
6	Credit Hour:	3			
7	Prerequisite/ Co-requisite:				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Comprehend probability theory			
	CLO2	Understand functions, calculus and transformation of stochastic processes			
	CLO3	Specify random processes as models			
	CLO4	Use random processes to electrical engineering applications.			
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:				

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√																√				
CLO2					√																
CLO3			√																√		
CLO4			√														√		√		

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1 : Basic Concepts Probability Theory a. Sample Space and Events		√						
b. Axioms and Properties of Probability		√						
c. Conditional Probability		√						
d. Independence of Events								
Chapter 2 : Random Variables 2.1. The Cumulative Distribution Function		√	√					

	2.2. Continuous Random Variables and Probability Density Functions		√	√					
	2.3. Discrete Random Variables and Probability Mass Functions								
	2.4. Some Special Continuous and Discrete Probability Distributions								
	2.5. Expected Value and Variance of Random Variables								
	2.6. Functions of One Random Variable								
	Chapter 3 : Multiple Random Variables 3.1. Two Random Variables		√	√					
	3.2. Joint Cumulative Distribution Function of Two Random Variables		√	√					
	3.3. Joint Probability Density and Mass Functions of Two Random Variables		√	√	√				
	3.4. Correlation and Covariance of Two Random Variables		√	√	√				
	Chapter 4 : Random Processes 4.1. Classification of Random Processes		√	√	√				
	4.2. Power Spectral Densities of Random Processes		√	√	√				
	4.3. Response of Linear Systems to Random Inputs	√	√	√					
	4.4. Power Spectral Estimation and Stochastic Filter Design	√	√	√					
	Total								

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quizzes	5	√		
2	Assignments	15		√	
3	Tests	25	√		
				Total	

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	√		
			Grand Total SLT	

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	
13	Textbook and reference:	1	Albert Leon-Garcia , Probability and Random Processes for Electrical Engineering, 2nd Edition, Addison-Wesley, 1994 .
		2	D. Bertsekas and J. Tsitsiklis, Introduction to Probability, MIT, 2002.
		3	E.Wong, Introduction to Random Processes, 2nd Edition, Springer, 2005.
		4	S. Ross, A first course in probability, 8th Edition, Pearson Prentice Hall 2010.

2.17.2.13 Computational Methods

	Addis Ababa Science and Technology University	
1	College: Natural and Social Science	Department: Mathematics
	Course Name	Computational Methods
	Course Code:	ECEg3101
3	Synopsis:	The course aims at introducing students in finding numerical solutions to problems for which analytical solutions either do not exist or are not readily or cheaply obtainable. It enables students to apply linear algebra and calculus. It also aims to helps student develop programming skills.
4	Name(s) of Academic Staff:	Getachew Derso, Adem Guluma, Zebene Girma, Solomon Tesfaye, TigabuKassa
5	Semester and Year offered:	Semester: II Year: 2
6	Credit Hour:	4
7	Prerequisite/ Co-requisite:	Applied Engineering Mathematics III (Math-2022) and C++ Programming (ECEg2108)
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Describe basic concepts in error estimation
	CLO2	Analyze Nonlinear equations
	CLO3	Analyze the concepts of solving System of linear equations and Eigen vectors
	CLO4	Evaluate and interpret Curve fitting, Finite differences and Interpolations
	CLO5	Analyze Numerical Differentiation and Integration
	CLO6	Develop Understanding of how to find Numerical Solutions of ODEs

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assign ment	Project	Lab-report
CLO1	√												√	√			√				
CLO2		√											√	√			√		√		
CLO3		√											√	√			√		√		
CLO4				√									√	√			√		√		
CLO5		√											√	√				√			
CLO6	√												√	√						√	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1:Basic concepts in error estimation	1	4	5	1		1	6	17

	1.1Sources of errors								
	1.2Absolute and relative errors								
	1.3Approximations of errors								
	1.4 Truncation errors and the Taylor series								
	1.5 Propagation of errors								
	Chapter 2:Nonlinear equations 2.1Bisection method	2	6	7	2		1	7	23
	2.2Secant method								
	2.3Newton-Raphson method								
	2.4 Fixed point iteration								
	Chapter 3:System of linear equations, Eigen values and Eigen vectors 3.1Direct methods for system of linear equations 3.1.1 Gaussian method* 3.1.2 Gaussian method with partial pivoting 3.1.3 Jordan's method* 3.1.5 Matrix decomposition 3.1.4 Jordan's method for matrix inversion*	3	6	7	2		1	7	23
	3.2Indirect methods for SLE								
	3.3Eigen values and Eigen vectors								
	Chapter 4:Curve fitting, Finite differencesand Interpolations 4.1Shift, Forward difference, backward difference and Central difference operators	4	8	7	2		1	7	25
	4.2Lagrange's interpolation formula								
	4.3Newton's divided difference interpolation formula								
	4.5 Least square approximation								
	Chapter 5: Numerical Differentiation and	5	4	5	2		1	6	18

	Integration 5.11Numerical Differentiation								
	5.2Numerical Integration (Trapezoidal and Simpson's rule)								
	Chapter 6: Introduction to Numerical Solutions of ODEs	6	2	4	1		1	4	12
	6.1 Euler's method								
	6.2 Runge-Kutta methods								
	Total	6	30	35	10		6	37	118

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	20	2	6	8
2	Assignments	10	1	9	10
3	Lab-report	15	1	2	3
4	Quiz	5	1	0	1
				Total	22

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	3	17	20
			Grand Total SLT	160

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Textbook and reference:	1	Richard L. Burden, Numerical Analysis, 1981, 2nd Ed.
		2	Steven C. Chapraand Raymond P. Canale, Numerical Methods for Engineers, 5th
		3	Robert Ellis and Denny Glick, Calculus with Analytical Geometry 3rd Ed.

2.17.2.14 Applied Electronics I

Addis Ababa Science and Technology University					
1	College: Electrical and Mechanical Engineering		Department: Electrical Engineering		
	Course Name	Applied Electronics I			
	Course Code:	ECEg3103			
3	Synopsis:	The course focuses on discussing basic semiconductor theory, semiconductor diodes and their applications, BJT, FET, Amplifier frequency response, Multistage amplifiers, Power amplifier and Tuned amplifiers. It also introduces the basic measurements on characteristics of electronic devices and circuits, semiconductor diode characteristics, rectification and filtering, bipolar junction transistor characteristics, transistor biasing and operating point stability, transistor amplifier, frequency response, multistage amplifier, power amplifier and Tuned amplifier.			
4	Name(s) of Academic Staff:	-			
5	Semester and Year offered:	Semester:	I	Year:	3
6	Credit Hour:	4(L:2, P:3, T:3)			
7	Prerequisite:	Fundamentals of Electrical Engineering (ECEg2102)			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Construct the concept of basic semiconductor theory, semiconductor diodes and their application			
	CLO2	Develop the characterstics of BJT, FET and amplifiers.			
	CLO3	Design and simulate frequency response of an amplifier, Multistage amplifiers, power amplifiers and Tuned amplifiers.			
	CLO4	Conduct an experiment on diode, BJT characteristics, operating point and amplifier, frequency response of multistage, power and tuned amplifier.			
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:				

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√																				
CLO2	√																				
CLO3	√				√																
CLO4	√			√					√												

10	Transferable Skills
1	Circuit design in Multisim / other related software
2	Practically design basic electronics

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)						
		L	T	P	O			
Chapter 1: Basic Semiconductor Theory 1.1 Introduction to semiconductor materials and properties	CLO1							4 (break down the number for L, T, P, O)
1.2 current in semiconductor								
1.3 N-type and P-type semiconductor								
1.4 The PN junction		√						

	Chapter 2: Semiconductor diodes and their application 2.1 Diode operation								
	2.2 Voltage-current (V-I) characteristics								4
	2.3 Diode models	CLO1 CLO4	√		√				
	2.4 Half-wave and full-wave rectifiers								
	2.5 Special-purpose diodes								4
	Chapter 3: Bipolar Junction Transistors 3.1 Bipolar Junction Transistor (BJT)								
	3.2 Basic BJT operation								
	3.3 BJT characteristics and parameters								
	3.4 The BJT as an amplifier	CLO2			√				4
	3.5 Small signal modes and operation	CLO3	√						
	3.6 Amplifier frequency response	CLO4							4
	Chapter 4: BJT small signal amplifiers 4.1 BJT amplifiers								
	4.2 CE BJT amplifier	CLO2							4
	4.3 CB BJT amplifier	CLO3	√		√				
	4.4 CC BJT amplifier	CLO4							4
	Chapter 5: Field effect transistors (FETs) 5.1 The JFETs								
	5.2 JEFT characteristics and parameters								
	5.3 JEFT biasing								4
	5.4 The ohmic region								
	5.5 The MOSFET								
	5.6 MOSDET characteristics and parameters	CLO2 CLO3	√						
	5.7 MOSFET biasing								4
	5.8 JFET amplifiers and switching circuit								
	Chapter 6: Multistage Amplifiers 6.1 Introduction to Multistage amplifiers	CLO2 CLO3							
	6.2 Different cascading of amplifiers	CLO4							
	6.3 Analysis of cascaded amplifiers		√		√				4
	Chapter 7: Power Amplifiers and Tuned Amplifiers 7.1 The class A power amplifier	CLO3							
	7.2 The class B and class AB push-pull amplifiers	CLO4	√		√				4
	7.2 The class C amplifiers								
	Total								

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F
1	Tests	15%		
2	Quize	10%		
3	Lab-report	15%		
4	Assignments	10%		
				Total

Final Exam	Percentage 50 (%)	F2F	NF2F
Final Exam	50%		
			Grand Total SLT

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non-Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

1	Special requirements	1	Workshop

2	and resources to deliver the course	2	Computer Lab
		3	Software – Multisim
1 3	Textbook and reference:	1	Thomas L. Floyd, Electronic devices, electron flow version, 9th Ed, Pearson, 2011.
		2	Donald A. Neamen, Microelectronics: Circuit Analysis and Design,4th Ed, McGraw-Hill, 2009.
		3	by Theodore F. Bogart, Jeffrey S. Beasley, et al., Electronic Devices and Circuits, 6th Ed, Pearson, 2019.
		4	Albert Malvino , David Bates, Electronic Principles, 8th Ed, McGraw-Hill, 2015.
		5	Robert Boylestad, Louis Nashelsky: Electronic Devices and Circuit Theory S. Sedra and C. Smith, Microelectronic Circuits

2.17.2.15 Signals and Systems Analysis

Addis Ababa Science and Technology University			
1	College: Electrical and Mechanical Engineering		Department: Electrical and Computer Engineering
2	Course Category	Core Module: Core course	Course Code: ECEg3105
	Course Name	Signals and Systems Analysis	
3	Synopsis:	The course aims and enables student to understand and apply the representation, classification, characterization and analysis of signals and systems in time and frequency domains.	
4	Name(s) of Academic Staff:		
5	Semester and Year offered:	Semester: I	Year: III
6	Credit Hour:	3	
7	Prerequisite/ Co-requisite:	Math-2042**:** Applied Mathematics IIIB	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Understand representation and classification of signals and systems, convolution, differential equation representation of LTI systems	
	CLO2	Analyze continuous-time signals and systems using Fourier Series and Fourier Transforms	
	CLO3	Analyze continuous-time and discrete-time signals using the Laplace transform	
	CLO4	Analyze continuous-time and discrete-time signals using the Z-transform	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignme	Project	Lab-report
CLO1	√																√				
CLO2		√																			
CLO3		√																	√		
CLO4		√															√		√		

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)
	1
	2
	3…etc.

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Fundamental Concepts of Signals and Systems 1.1 Signals and Classification of Signals 1.2 Basic Continuous-time and Discrete-time Signals	1	5	6			3.5	2.5	17

	1.3 Systems and Classification of Systems								
	Chapter 2: The impulse response and convolution 2.1. Impulse and Step Response of LTI Systems 2.2. Continuous-Time LTI Systems and the Convolution Integral 2.3. Solving Ordinary Linear Differential Equations (OLDE)	1	5	9			4	3	21
	Chapter 3: Frequency Domain Analysis of Continuous-Time Signals and Systems 3.1. The Continuous-time Fourier series (CTFS) 3.2. The Continuous-time Fourier transform (CTFT) 3.3. The Frequency Response of Continuous-Time LTI Systems	1,2	8	9			5	4	26
	Chapter 4: Laplace Transform and Its Inverse 4.1. Laplace Transform and Its Properties 4.2. Relationship between Fourier and Laplace Transforms 4.3. System Functions and Pole-Zero Plots 4.4. Solutions to Differential Equations using Laplace Transform Method	1,3	5	9			4	3	21
	Chapter 5: Z-Transform and Its Inverse 5.1. The Z-transform and Its inverse transform 5.2. System Functions and Pole-Zero Plots 5.3. Introduction to Discrete Time Fourier Transform (DTFT)	1,4	5	9			4	4	22
	Total		28	42			20.5	13.5	107

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quizzes	5	√		1
2	Assignments	15		√	4
3	Tests	25	√		5
				Total	10

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	√		3

	Grand Total SLT		120
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.		
12	Special requirements and resources to deliver the course	1	
		2	
		3	
13	Textbook and reference:	1	Signals and Systems, Second Edition, Simon Haykin and Barry Van Veen, John, 2003
		2	Philip Denbigh: System Analysis and Signal, 1988.
		3	Signals and Linear Systems, R.A. Gabel and Richard A. Roberts
		4	Signals and Linear Systems, Lathi

2.17.2.16 Electromagnetic Fields

Addis Ababa Science and Technology University			
1	College: Electrical and Mechanical Engineering		Department: Electrical Engineering
2	Course Category	Core Course	Course Code: ECEg3107
	Course Name	Electromagnetic Fields	
3	Synopsis:	This course lays the foundation for understanding basic electromagnetic concepts, fundamental governing laws and guiding principles which students can apply in subsequent courses. The course covers: Vector Algebra, Scalar and Vector Fields, Coordinate Systems and Transformation, Vector Calculus, Line, Surface and Volume Integrals, Vector Differential Operator, Electrostatic fields, Coulomb's and Gauss's Laws for static electric charge distributions in vacuum and material bodies, Electrostatic Boundary Value Problems, Poisson's and Laplace's equations, Resistance and Capacitance, Magnetostatic Fields, Biot-Savart's and Ampere's Laws for steady state current source in free and material space, Magnetic Forces, Materials, and Devices, Faraday's Law, Maxwell's Equations for Static and dynamic (time-varying) Electromagnetic Fields	
4	Name(s) of Academic Staff:		
5	Semester and Year offered:	Semester: I	Year: 3
6	Credit Hour:	3	
7	Prerequisite/ Co-requisite:	ECEg2102: Fundamentals of Electrical Engineering Math-2022: Applied Engineering Mathematics-III	

8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:
CLO1	Describe and analyze static and time-varying electromagnetic fields in different coordinate systems using vector calculus
CLO2	State the fundamental laws governing electrostatics and magnetostatics and analyze static electric and magnetic fields in vacuum and material bodies
CLO3	Apply Laplace's and Poisson's equations to identify and solve electrostatic boundary value problems involving resistance and capacitance
CLO4	Interpret and apply differential and integral forms of Maxwell's equations to solve diverse electromagnetic problems

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assign ment	Project	Lab-report
CLO1	√												√	√			√	√	√		
CLO2	√												√	√			√	√	√		
CLO3	√	√											√	√			√		√		
CLO4	√	√											√	√			√	√	√		

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)
1	
2	
3…etc.	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities			Total (SLT)
		Guided learning (F2F)	Guided Learning (NF2F)	Independent Learning (NF2F)	

			L	T	P	O			
	Chapter 1: Review of Vector Calculus 1.1. Scalar and Vector Fields 1.2. Line, Surface, and Volume Integrals 1.3. Gradient of a Scalar field 1.4. Divergence and Curl of a Vector Field 1.5. Laplacian of a Scalar Field 1.6. Solenoidal and Irrotational Vector Fields 1.7. Helmholtz's Theorem 1.8. Orthogonal Curvilinear Coordinates	1	6	9			1	6	22
	Chapter 2: Electrostatic Fields 2.1. Coulomb's Law 2.2. Electric Field $\mathbf{E}$ 2.3. Electric Flux Density $\mathbf{D}$ 2.4. Gauss's Law 2.5. Electric Potential V 2.6. Relationship between $\mathbf{E}$ *and* V 2.7. Electric Dipole 2.8. Energy in Electrostatic Fields	1,2	6	9			1	6	22
	Chapter 3: Electric Fields in Material Body 3.1. Convection and Conduction Currents 3.2. Polarization in Dielectrics 3.3. Boundary Conditions	1,2	4	6			1	4	15
	Chapter 4: Electrostatic Boundary-Value Problems 4.1. Poisson's and Laplace's Equations 4.2. Resistance and Capacitance	1,3	2	3			1	2	8
	Chapter 5: Magnetostatic Fields 5.1. Biot-Savart Law 5.2. Ampere's Circuital Law 5.3. Magnetic Flux Density B 5.4. Magnetic Vector Potential A 5.5. Maxwell's Equations for Static EM Fields	1,2,4	4	6			1	4	15
	Chapter 6: Magnetic Forces and Materials 6.1. Forces due to Magnetic Fields 6.2. Magnetic Torque and Moment 6.3. A Magnetic Dipole 6.4. Magnetic Boundary Conditions 6.5. Inductors and Inductances 6.6. Magnetic Energy	1,2	4	6			1.5	4	15.5

	Chapter 7: Introduction to Time Varying EM Fields 7.1. Faraday's Law s 7.2. Transformer and motional emfs 7.3. Maxwell’s equations for time varying EM fields	1,2,4	2	3			1	2	8
	Total		28	42			7.5	28	105.5

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	25	√		5
2	Assignments	15		√	5.5
3	Quiz	10	√		1
				Total	11.5
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	√		3
				Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO’s numbering in item 9.

12	Special requirements and resources to deliver the course	1	Choose an item.
		2	Choose an item.
		3	Choose an item.
13	Textbook and reference:	1	Matthew N. O. Sadiku, ***Elements of Electromagnetics***; 6th/7th ed, 2015/18
		2	William H. Hayt, Jr. and John A. Buck, ***Engineering Electromagnetics***, 8th ed, 2012
		3	Félix S. Bloise, Rafael M. Ferro, Ana B. Rojo, Francisco G. Latasa, ***Solved Problems in Electromagnetics***, Springer-Verlag Berlin Heidelberg, 2017

2.17.2.17 Object Oriented Programming

Addis Ababa Science and Technology University					
1	College: Electrical and mechanical engineering		Department: electrical and computer engineering		
	Course Name	Object Oriented Programming			
	Course Code:	ECEg3109			
3	Synopsis:	This course is designed to provide the fundamental theories and principles and techniques of object-oriented programming paradigms. Topics to be dealt with are: classes, objects, data abstraction, encapsulation and information-hiding, overloading, subclasses and inheritance, polymorphism, class hierarchies and exception handling. This course also gives chances to students to work on object-oriented programming language during practical session to implement; test and experiment an object oriented paradigm of the program design and implementation.			
4	Name(s) of Academic Staff:	Yonas Tesfaye yonas.tesfaye@aastu.edu.et			
5	Semester and Year offered:	Semester:	I	Year:	3rd
6	Credit Hour:	3			
7	Prerequisite/ Co-requisite:	C++ Programming (ECEg2108)			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				

8	CLO1	Apply the Java programming basics for object oriented
	CLO2	Apply and design the object-oriented process
	CLO3	Identify and apply class design guidelines
	CLO4	Differentiate different types of interface and explain and apply the concept of polymorphism in the OOP
	CLO5	Identify and differentiate different types of pattern for GUI programming
6	CLO6	Identify and apply the concept of inheritance and abstract classes in OOP

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
													Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	✓												✓		✓		✓			✓	
CLO2			✓										✓		✓		✓			✓	
CLO3					✓								✓		✓		✓			✓	
CLO4					✓								✓		✓		✓			✓	
CLO5			✓										✓		✓		✓			✓	
CLO6				✓									✓		✓		✓			✓	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	

	3…etc.	

11	Distribution of Student Learning Time (SLT)								
	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	Chapter 1: A crash course in JAVA 1.1 Hello world in JAVA	CLO1	1		2		✓		3
	1.2 Documentation comments	CLO1	1		2		✓		3
	1.3 primitive types	CLO1	1		2		✓		3
	1.4 control flow statements	CLO1	1		2		✓		3
	1.5 object referances	CLO1	1		2		✓		3
	1.6 parameter passing	CLO1	1		2		✓		3
	1.7 Basic exception handling	CLO1	1		2		✓		3
	1.8 Strings	CLO1	1		2		✓		3
	1.9 Read input	CLO1	1		2		✓		3
	1.10 Array lists and linked lists	CLO1	1		2		✓		3
	1.11 Arrays	CLO1	1		2		✓		3
	1.12 Static fields and methods	CLO1	1		2		✓		3
	Chapter 2: The object oriented design process 2.1 From problem to code	CLO2	1		1		✓		2
	2.2 the object and class concepts	CLO2	2		1		✓		3
	2.3 Identifying classes	CLO2	2		1		✓		
	2.4 Identifying responsibilities	CLO2	1		1		✓		2
	2.5 Relationships between classes	CLO2	1		1		✓		2
	2.6 Use cases	CLO2	1		1		✓		2
	2.7 UML class diagrams	CLO2	2		1		✓		3
	2.8 Sequence diagrams	CLO2	2		1		✓		3
	2.9 using Javadoc for design documentation	CLO2	1		1		✓		2
	Chapter 3: Guideline for class design 3.1 An overview of the date classes in java library	CLO3	1		1		✓		2
	3.2 Designing a day class	CLO3	2		1		✓		3
	3.3 Three implementation of the day class	CLO3	2		1		✓		3
	3.4 The importance of encapsulation	CLO3	2		1		✓		3
	3.5 Analyzing the quality of an interface	CLO3	1		1		✓		2
	3.6 Programming by contract	CLO3	1				✓		1
	3.7 Unit testing	CLO3	2		1		✓		3
	Chapter 4: Interface types and polymorphism 4.1 The icon interface type	CLO4	1		1		✓		2

	4.2 Polymorphism	CLO4	1		1		✓		2
	4.3 The comparable and comparator interface type	CLO4	2		1		✓		3
	4.4 Anonymous classes	CLO4	1		1		✓		2
	4.5 Frames and user interface components	CLO4	2		2		✓		4
	4.6 User interface actions	CLO4	2		2		✓		4
	4.7 Timers	CLO4	1		1		✓		2
	4.8 Designing an interface types	CLO4	2		2		✓		4
	Chapter 5: Patterns and GUI programming 5.1 The iterator as a pattern	CLO5	1		1		✓		2
	5.2 The pattern concept	CLO5	1		1		✓		2
	5.3 The observer pattern	CLO5	1		1		✓		2
	5.4 Scroll bars and decorator pattern	CLO5	1		1		✓		2
	Chapter 6: Inheritance and abstract classes 6.1 The concept of inheritance	CLO6	2		2		✓		4
	6.2 Graphics programming with inheritance	CLO6	2		2		✓		4
	6.3 Abstract classes	CLO6	2		2		✓		4
	6.4 The template method pattern	CLO6	1		1		✓		2
	6.5 Protected interference	CLO6	1		1		✓		2
	6.6The hierarchy of swing components	CLO6	1		1		✓		2
	6.7 The hierarchy of exception classes	CLO6	1		1		✓		2
	6.8 When not to use inheritance	CLO6	1		1		✓		2
	Total								120

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test	10	✓		
2	Project	40	✓		
				Total	
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	✓		120
				Grand Total SLT	

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software like Eclips, Netbeans or BlueJ
		2	Computer lab
13	Textbook and reference:	1	Cay Horstmann, Object oriented design and pattern, 2n Ed., 2006
		2	Detiel and Deitel, Java How to program, pearson Education Inc.,8^{th} Edition, 2010
		3	Keneth Litwak, Pure Java 2, Sam publishing Inc.,2000

2.17.2.18 Research Methods and Presentation

	Addis Ababa Science and Technology University	
1	College: Electrical and Mechanical Engineering	Department: Electrical Engineering
	Course Name	Research Methods and Presentation
	Course Code:	ECEg3111
3	Synopsis:	This course deals with discussion of research and development methods. Moreover, it addresses current and emerging research topics in the area of computer engineering. Selection of topics for individual projects depends on the instructors and department. Literature review and analysis, intensive readings, discussions and reports will be the main activities and assessment methods
4	Name(s) of Academic Staff:	Dereje Yohannes
5	Semester and Year offered:	Semester: II Year: 4
6	Credit Hour:	2
7	Prerequisite/ Co-requisite:	None
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Identify the aims and meanings of a research
	CLO2	Differentiate the procedures to do a scientific research
	CLO3	Apply different types of research methods
	CLO4	Identify research problems and formulate research questions in the fields of Electrical and Computer Engineering
	CLO5	Implement an effective way of presenting a research output
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment (Test, Quiz, Assig)	
													L	T	P	O		
CLO1	√												√				√	
CLO2				√									√					
CLO3					√								√					√
CLO4		√											√					
CLO5										√			√					

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			

	Chapter 1: Basic concepts of research 1.1 Definitions of Research	CLO1	1					1	2
	1.2 Research Characteristics	CLO1	1						1
	1.3 Science, the Scientific Method, and Research	CLO1	1						1
	1.4 Structure of Research	CLO1	1					1	2
	1.5 The Scientific Research Method	CLO1	1					1	2
	1.6 The Process of Research	CLO1	1					1	2
	Chapter 2: Categories of a scientific research and formulating the topic 2.1 Research Classifications	CLO2, CLO3, CLO4	1					1	2
	2.2 Research topics	CLO2, CLO3, CLO4	0.5					1	1.5
	2.3 Attributes of a good research topic	CLO2, CLO3, CLO4	0.5					1	1.5
	2.4 Generating research ideas	CLO2, CLO3, CLO4	1					1	2
	2.5 Refining research ideas	CLO2, CLO3, CLO4	0.5					1	1.5
	2.6 The Delphi technique	CLO2, CLO3, CLO4	1					1	2
	2.7 Points to consider in finding a research topic	CLO2, CLO3, CLO4	1					1	2
	2.8 Writing research questions	CLO2, CLO3, CLO4	1					1	2
	2.9 Goldilocks test	CLO2, CLO3, CLO4	1					1	2
	2.10 Turning ideas into research projects	CLO2, CLO3, CLO4	1					1	2
	Chapter 3: Writing research proposal 3.1 PURPOSE of the research proposal	CLO2, CLO3, CLO4	0.5						0.5
	3.2 What the proposal should contain?	CLO2, CLO3, CLO4	0.5						0.5
	3.3 Tips for successful proposal writing	CLO2, CLO3, CLO4	0.5						0.5
	3.4 Research Proposal Format	CLO2, CLO3, CLO4	0.5						0.5
	3.5 Structure of the proposal	CLO2, CLO3, CLO4	1					1	2
	Chapter 4: Research Report Writing, citation and Plagiarism 4.1 What is a Research report?	CLO4	1					1	2
	4.2 Significance of Report	CLO4	0.5						0.5
	4.3 Format of the Report	CLO4	0.5						0.5
	4.4 The Generic Report Skeleton	CLO4	1					1	2
	4.5 Research ethics	CLO4	1					1	2
	4.6 Plagiarism	CLO4	1					1	2

4.7 Proper Citations and referencing	CLO4	1					1	2
Chapter 5: Effective presentation skills 5.1 What is Presentation?	CLO5	0.5					1	1.5
5.2 Planning Your Presentation	CLO5	0.5						0.5
5.3 The Presentation Sequence	CLO5	0.5						0.5
5.4 Purpose of Visual Aids	CLO5	1					1	2
5.5 Designing Good Slides	CLO5	1					1	2
5.6 Effective Presentation Techniques	CLO5	1					1	2
5.7 What Makes an Effective Speaker?	CLO5	1					1	2
5.8 Presentation Tips	CLO5	1					1	2
5.9 Common failings of presenters	CLO5	1					1	2
Total		30					37	61

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	10 %	2	2	4
2	Assignments	10 %		3	3
3	Quize	10 %		1	1
4	Tests	5%		1	1
5	Project	15 %		4	4
				Total	13
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50 %	2	4	6
				Grand Total SLT	80

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Choose an item.	A lecture room with LCD projector fixed is sufficient to deliver the course
		2	Choose an item.	
		3	Choose an item.	
13	Textbook and reference:	1	Practical Research: Planning and Design (March 2004): Paul D. Leedy, Jeanne E. Ormrod, Jeanne Ellis Ormrod, Paperback, Prentice Hall	
		2	Graduate research: A guide for Students in the sciences (May 1998): Robert V. Smith, Paperback, University of Washington	
		3	Research Methods: A process of Inquiry ((May 2006)): Anthony M. Graziano, Michael L. Raulin, Hardcover, Prentice Hall	
		4	Introduction to qualitative research methods: A guidebook and resource (1998): Taylor, Steven J.; Bogdan, Robert, Hoboken, (3rd Ed.) NJ, US: John Wiley and Sons Inc.	

2.17.2.19 Electrical Workshop Practices I

	Addis Ababa Science and Technology University					
1	College: Electrical and Mechanical Engineering			Department: Electrical Engineering		
2	Course Category	Core course		Course Code: ECEg3113		
	Course Name	Electrical Workshop Practice I				
3	Synopsis:	In this course we discuss about: General Safety rules, Common types of Electrical hand Tools, Wiring materials and accessories, Termination, splicing of solid and flexible wires, Soldering; Residential installation which includes Lighting, Power and Signal circuits; Fire Alarm installation, Security camera installation, testing and inspecting these electrical installations.				
4	Name(s) of Academic Staff:	Tsehay Endris				
5	Semester and Year offered:	Semester:	II	Year:	3	
6	Credit Hour:	1				
7	Prerequisite/ Co-requisite:	None				

8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Explain electrical Safety Rules, regulations, standards and Familiarize the working environments of electrical engineering workshops
	CLO2	Identify Common types of Electrical hand Tools and different electrical materials, components and accessories used in residential installation
	CLO3	Apply electrical Safety Rules, regulations and standards
	CLO4	Perform splicing, soldering and Residential Installations

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignmen	Project	Lab-report
CLO1	√														√			√			
CLO2				√											√		√		√		
CLO3						√									√						
CLO4									√						√	``			√	√	√

Indicate the *relevancy* between the CLO and PO by ticking "√" on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1	Group working skills
2	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Termination Splicing and soldering 1.1: Explain electrical Safety Rules regulations and standards	CLO1 CLO3			1			0.5	1.5

	1.2: Identify Common types of Electrical hand Tools and different electrical materials, components, and accessories	CLO2			1				1
	1.3: Practicing each type of splicing and perform soldering of the spliced wire	CLO4			1			0.5	1.5
	Chapter 2: Residential Installation 2.1 Perform wiring of Lighting circuit, Power Circuit and Signal Circuit	CLO4			15			1	16
	2.2 Perform Security camera installation	CLO4			3			1	4
	2.2 Perform Fire alarm installation	CLO4			3			1	4
	Total				24			4	28hrs

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quize	5	1hrs	0.5hrs	1.5hrs
2	Tests	5	1hrs	0.5hrs	1.5hrs
3	Lab-report	10	0.5	1hrs	1.5hrs
4	Assignments	10	0.5hrs	1hrs	1.5hrs
5	Project	20	0.5hrs	2.5hrs	3hrs
Total					9hrs

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	1.5hrs	1.5hrs	3hrs
			Grand Total SLT	40hrs

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non-Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Workshop
		2	
		3	
13	Textbook and reference:	1	Electrical workshop practices I laboratory manual prepared by the instructor
		2	Basic shop practical in electrical engineering. Hans. Dhanpat Raiand Co. (PVT.) Ltd1999

2.17.2.20 Applied Electronics II

Addis Ababa Science and Technology University																						
1	College: Electrical and Mechanical Engineering								Department: Electrical Engineering													
	Course Name		Applied Electronics II																			
	Course Code:		ECEg3102																			
3	Synopsis:		The course focuses on discussing advanced electronics circuits and concepts of feedback system. Discusses the working principles of differential and operational amplifiers. Design and simulate the circuits of differential and operational amplifiers using Multisim. Discuss, design and simulate applications of amplifiers. Introduces to the wave shaping circuits such as oscillators and Multivibrators, timers and switching circuits.																			
4	Name(s) of Academic Staff:		--																			
5	Semester and Year offered:		Semester:	II					Year:	3												
6	Credit Hour:		3(L:2, P:3, T:0)																			
7	Prerequisite:		ECEg3103-Applied Electronics I																			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:																					
	CLO1	Construct the concept of feedback system.																				
	CLO2	Develop the concept of amplifiers, Multivibrators, Schmitt triggers and filters.																				
	CLO3	Design and simulate Oscillators, Multivibrators, Schmitt triggers and filters.																				
	CLO4	Conduct an experiment on differential amplifier, Op-Amps, Oscillators and Schmitt triggers using 741 and 555 timers.																				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:																					
		Program Learning Outcomes (PO)																				
														Teaching Methods				Assessment				
	Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
	CLO1	√												√		√			√			√
	CLO2	√												√				√			√	
	CLO3			√										√				√			√	
	CLO4				√									√		√						√
10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)																					
	1	Circuit design in Multisim																				
	2	Practically design basic electronics																				
11	Distribution of Student Learning Time (SLT)																					

Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F) L	T	P	O	Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT)
Chapter 1: Feedback Amplifiers 1.1 Introduction to feedback systems								
1.2 Basic feedback concept (negative and positive feedback systems)	CLO1	√		√				4
1.3 Loop gain and stability of feedback circuits								

	1.4 Ideal feedback topologies								
	Chapter 2: Differential amplifiers 2.1 Introduction to differential amplifier				√				
	2.2 A small review on BJT amplifiers	CLO1 CLO4	√						4
	2.3 Basic operation of differential amplifiers								
	2.4 Small signal analysis of differential amplifiers								
	2.5 Ways of improving voltage and common mode rejection ratio								4
	Chapter 3: Operational Amplifiers 3.1 Characteristics and operation of Op-Amp								4
	3.2 The ideal Op-Amp circuit analysis	CLO1 CLO2 CLO4	√		√				
	3.3 Inverting, non-Inverting and voltage follower Op-Amps								
	3.4 Open loop and closed loop voltage gains in Op-Amp								
	3.5 Op-Amp performance parameters								4
	3.6 Application of Op-Amps in liner circuits								
	Chapter 4: Active Filters 4.1 Introduction to Low pass and High pass filters								
	4.2 Low pass and High pass filter circuits	CLO3	√						4
	4.3 Analog Integrated circuits and their applications								4
	Chapter 5: Oscillators 5.1 Operation of Oscillators								
	5.2 Phase-shift Oscillator	CLO1 CLO3 CLO4							
	5.3 Wien Bridge Oscillator								4
	5.4 Crystal Oscillator		√		√				
	5.5 Unijunction Oscillator								4
	Chapter 6: Multivibrators 6.1 Introduction to Multivibrators								
	6.2 Operation of Mono-stable, Bi-stable and A-stable MV.	CLO1 CLO3 CLO4							4
	6.3 Multivibrators using 555 timers		√		√				4
	6.4 Operation of Schmitt trigger								
	Total								

Assessment				
Continuous Assessment	Percentage Total-50(%)	F2F	NF2F	SLT
1 Tests	15%			

	2	Quiz	10%			
	3	Lab-report	15%			
	4	Assignments	10%			
	5	Final Exam				50%
					Total	
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50%			
					Grand Total SLT	
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non-Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					

12	Special requirements and resources to deliver the course	1	Workshop
		2	Computer Lab
		3	Software – Multisim
13	Textbook and reference:	1	Microelectronics: Circuit Analysis and Design,4th edition by Donald A. Neamen
		2	Dept. Electrical and Electronics Eng, Applied Electronics II (EEEG – 2202), Prepared by: Sh. F
		3	Electronic Devices and Circuit Theory, by Robert Boylestad Theodore F. Bogart, Electronic Devices and Circuits
		4	Malvino, Electronic Principles
		5	Robert Boylestad, Louis Nashelsky: Electronic Devices and Circuit Theory S. Sedra and C. Smith, Microelectronic Circuits Jacob Millman, microelectronics digital and analog circuit system Sanjeev Gupta, electronic circuit and device

2.17.2.21 Digital Logic Design

Addis Ababa Science and Technology University					
1	**College**: Electrical and Mechanical Engineering			**Department: Electrical Engineering**	
	Course Name	Digital Logic Design			
	Course Code:	ECEg3104			
3	Synopsis:	Digital Logic Design is a comprehensive study of the principles and techniques of modern digital system. It provides an overview of the principles underlying number systems, arithmetic operations, decimal and alphanumerical codes, Boolean algebra, combinational and sequential circuits. Furthermore, analysis and design of combinational sequential logic system is discussed.			
4	Name(s) of Academic Staff:				
5	Semester and Year	Semester:	II	Year:	3
6	Credit Hour:	4			
7	Corequisite	Applied Electronics II (ECEg3102)			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Identify fundamental concepts of digital logic design.			
	CLO2	Apply techniques related to the design and analysis of digital circuits.			
	CLO3	Analyze small-scale combinational and sequential digital circuits.			
	CLO4	Design small-scale combinational and synchronous sequential circuits.			
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:				

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Test	Quiz	Assignment	Project	Lab-report
													L	T	P	O					
CLO1	√												√				√				
CLO2		√											√	√				√	√		
CLO3			√										√						√		
CLO4				√									√	√					√	√	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		GL (F2F)				GL (NF2F)	IL (NF2F)	
		L	T	P	O			
Chapter 1: INTRODUCTION 1.1 Digital and Analogue Quantitates 1.2 Binary Digits, Logical Level 1.3 Digital Waveforms	CLO1	√						6
Chapter 2: Number System 2.1 Operations of Codes 2.2 Decimal and Binary Numbers 2.3 Decimal to/from Binary Conversion 2.4 1's and 2's Compliment 2.5 Signed Numbers 2.6 Hexadecimal and Octal Number 2.7 Binary Coded Decimal Number	CLO1	√	√	√				12
Chapter 3: LOGIC GATES 3.1 The Inverter 3.2 AND and OR Gates 3.3 NAND and NOR Gates	CLO1	√	√	√				6

	3.4 Exclusive OR and NOR Gates								
	Chapter 4: BOOLEAN ALGEBRA and LOGIC SIMPLIFICATION 4.1 Boolean Operations and Expression 4.2 Laws and Rules of Boolean Algebra 4.3 DE Morgan Theorems 4.4 Boolean Analysis of Logic Circuit 4.5 The K-Map	CLO2	√	√	√				12
	Chapter 5: COMBINATIONAL LOGIC 5.1 Function of Combinational Logic 5.2 Basic Combinational Logic Circuits 5.3 Implementing Combinational Logic 5.5 Adders 5.6 Decoders and Encoders 5.7 Multiplexers and De-multiplexers	CLO3 CLO4	√	√	√				12
	Chapter 6: SEUQNTIAL LOGICS 6.1 Flip-flops 6.2 Latches 6.3 Edge Triggered Flip-Flops 6.4 Master Slave Flip-Flops 6.5 Application	CLO3 CLO4	√	√	√				12
	Chapter 7: COUNTERS 7.1 Synchronous Counters 7.2 Asynchronous Counters 7.3 Up/Down Counters 7.4 Design of Synchronous Counters	CLO4	√	√					6
	Chapter 8: SHIFT REGISTERS 8.1 Basic of Shift Registers 8.2 Serial In Serial Out (SISO) Registers 8.3 Serial In Parallel Out (SIPO) 8.4 Parallel In Serial Out (PISO) 8.5 Parallel In Parallel Out (PIPO)	CLO4	√	√					6
	Total								72

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test-I	10	√		24
2	Test-II	10	√		24
3	Quiz	5	√		12
4	Assignment-I	10		√	24
5	Project	15		√	24
				Total	
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	√		72
				Grand Total SLT	**72**

12	Resource required	1	Software-Multisim
		2	Computer Lab
13	Textbook	1	Digital Fundamental, 9th edition, Prentice Hall, T.L. Floyd

2.17.2.22 Network Analysis and Synthesis

Addis Ababa Science and Technology University					
1	College: Electrical and Mechanical Engineering			Department: Electrical and Computer Engineering	
2	Module Category	Core Course		Course Code: ECEg3106	
	Course Name	Network Analysis and Synthesis			
3	Synopsis:	The course covers the techniques of modeling, analysis, design and synthesis of N-Port passive and active and passive electrical filters in a classical and a modern approach			
4	Name(s) of Academic Staff:				
5	Semester and Year offered:	Semester:	II	Year:	III
6	Credit Hour:	3			
7	Prerequisite/ Co-requisite:	ECEg3105: Signals and Systems Analysis			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Describe and analyze transform domain analysis of electrical circuits and networks			
	CLO2	Understand realizability of networks			
	CLO3	Synthesize one port and two port networks			
	CLO4	Design active and passive analog filters			

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO): PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods: L	T	P	O	Assessment: Test	Quiz	Assignme	Project	Lab-report
CLO1	√																√				
CLO2	√																				
CLO3		√																	√		
CLO4			√														√		√		

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1	
2	
3…etc.	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F) L	T	P	O	Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT)
Chapter 1: Introduction to Network Analysis and Synthesis 1.1 Networks and their developmental stages 1.2 Network Analysis, design and Synthesis Concepts	1	2				1	1	4

	Chapter 2: Network Transform Representation and Analysis 2.1 Analysis of First and Second Order Circuits 2.2 Network Functions 2.3 Poles and Zeros of Network Functions	1	4	9			2	3	18
	Chapter 3: Elements of Realizability Theory 3.1. Causality and Stability 3.2. Hurwitz Polynomials 3.3. Positive Real Functions	1, 2	4.5	6			2.5	3	16
	Chapter 4: Synthesis of Driving Point Function (One Port Network) 4.1. Elementary synthesis procedures 4.2. Foster and Cauer I and II realizations -synthesis of LC, RC, RL and general R, L, C and M dp functions.	1, 3	7.5	12			2.5	3	25
	Chapter 5: Two Port Networks 5.1. Two Port Network Parameters 5.2. Relationship between Two Port Network Parameters 5.3. Interconnection of Two Port Networks 5.4. Properties and Configurations of two port network 5.5. Synthesis of transfer functions (two port networks)	1,3	5	9			3	2	19
	Chapter 6: Passive and Active Filter Design Techniques 6.1. Filter categorization and specification 6.2. Passive Filter Design 6.3. Active Filter Design	1,4	5	6			3	2	16
	Total		28	42			14	14	98

	Assessment					
	Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
	1	Quizzes	5	√		1
	2	Assignments	15		√	4
	3	Tests	25	√		5
					Total	10
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50	√		3
					Grand Total SLT	111
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					

12	Special requirements and resources to deliver the course	1	
		2	
		3	
13	Textbook and	1	M.E. Van Valkenburg, Network Analysis, 3rd Edition, Prentice Hall, 1974

	reference:	2	F.F. Kuo, Network Analysis and Synthesis, 2nd Edition, Wiley, 1968
		3	V.K. Aatre, Network Theory and Filter Design, 1st Edition, New Age International, 1986
		4	A. Budak, Passive and Active Network Analysis and Synthesis, 1st Edition, Waveland, 1991

2.17.2.23 Digital Signal Processing

Addis Ababa Science and Technology University			
1	College: Electrical and Mechanical Engineering		Department: Electrical and Computer Engineering
2	Module Category	Core Course	Course Code: ECEg3108
	Course Name	Digital Signal Processing	
3	Synopsis:	The course mainly deals with digital signal processing: sampling and quantization, A/D and D/A converters, Discrete-time systems convolution, Z-transforms and its Implementation, Digital filter realizations Fast Fourier transforms digital filter design, decimation and interpolation, random signals, and some applications. It also introduce FIR and IIR Filters, Filter Design Methods, Interpolation and Decimation, Adaptive Signal Processing and its application, Image and Speech Processing.	
4	Name(s) of Academic Staff:		
5	Semester and Year offered:	Semester: II	Year: III
6	Credit Hour:	4	
7	Prerequisite/ Co-requisite:	ECEg3105: Signals and Systems Analysis	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Understand methods of discrete-time signal and system representation	
	CLO2	Analyze discrete-time signals and systems both in time domain and transform domain	
	CLO3	Identify basic structures of finite impulse response (FIR) and infinite impulse response (IIR) filters	
	CLO4	Design both FIR and IIR digital filters	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√																√				√
CLO2			√																		√
CLO3			√																√	√	√
CLO4			√														√		√	√	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Introduction to Digital Signal Processing 1.1 Basic Concepts of Digital Signal Processing 1.2 Digital Signal Processing Applications	CLO 1	4hrs					4hrs	8hrs

	1.3 Sampling and Quantization of Continuous-time Signals								
	Chapter 2: Fundamentals of Digital Signals and Systems 2.1. Discrete-time Signals 2.2. Classification of Discrete-time Signals 2.3. Discrete-time Systems 2.4. Classification of Discrete-time Systems	CLO 1	4hrs	6hrs	4hrs		3hrs	3hrs	20hrs
	Chapter 3: Analysis of Discrete-time Signals and Systems in Time Domain 3.1. Impulse Response of LTI Discrete-time Systems 3.2. Discrete-time Convolution Sum 3.3. Linear Constant Coefficient Difference Equation (LCCDE) Representation of Discrete-time Systems 3.4. Solving LCCDEs	CLO 2	6hrs	10hrs	6hrs		3hrs	3hrs	28hrs
	Chapter 4: Analysis of Discrete-time Signals and Systems in Transform Domain 4.1. Discrete-time Fourier Transform (DTFT) and Its Inverse 4.2. Z-Transform and Its Inverse 4.3. Frequency Response of LTI Discrete-time Systems 4.4. Transfer Function of LTI Discrete-time Systems	CLO 2	6 hrs	10hrs	10hrs		3hrs	4hrs	33hrs
	Chapter 5: Digital Filter Realization and Design 5.1. Block Diagram Representation 5.2. Basic Finite Impulse Response (FIR) Filter Structures 5.3. Basic Infinite Impulse Response (IIR) Filter Structures 5.4. Digital Filter Specifications 5.5. Finite Impulse Response (FIR) Filter Design 5.6. Infinite Impulse Response (IIR) Filter Design	CLO 3 CLO 4	8hrs	14hrs	20hrs		3hrs	10hrs	57hrs
	Total		28hrs	40hrs	40hrs		12hrs	24	144hrs

	Assessment					
	Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
	1	Quiz	5	√		0.5hr
	2	Assignments	10		√	2.5hrs
	3	Test	10	√		1hr
	4	Project	15		√	6hrs

	5	Lab-report	10		√	1hrs
					Total	13hrs
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50	√		3hrs
					Grand Total SLT	160hr
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					
12	Special requirements and resources to deliver the course	1	Software			
		2	Computer Lab			
		3	Simulation Room			
13	Textbook and reference:	1	A. Oppenheim and Schafer, Discrete-time Signal Processing, 3rd Ed, PEARSON INDIA, 2014.			
		2	Sanjit K.Mitra, Digital Signal Processing: A Computer Based Approach, 4th Ed, Tata McGraw-Hill, New Delhi, 2010.			
		3	S. J. Orfanidis, Introduction to Signal Processing, Prentice Hall, 1995.			

2.17.2.24 Electrical Machines I

Addis Ababa Science and Technology University			
1	College: Electrical and Mechanical Engineering		Department: Electrical Engineering
2	Course Category	Core Course	Course Code: ECEg3110
	Course Name	Electrical Machines I	
3	Synopsis:	In this course we discuss about: Principle of magnetics, Transformers, Induction Machine, DC Machine and synchronous Machine	
4	Name(s) of Academic Staff:	Tsehay Endris	
5	Semester and Year offered:	Semester: II	Year: 3
6	Credit Hour:	4	
7	Prerequisite/ Co-requisite:	ECEg3107: Electromagnetic Fields	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Explain basic concepts of Magnetics, and construction, principles of operations, analytical models of transformers, three phase Induction, DC and Synchronous Machines	
	CLO2	Analyze power requirements, Efficiency, operating characteristics of three phase Induction and DC Machines	
	CLO3	Perform Testing of Transformers, Starting and speed control of three phase Induction and DC Machines	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√	√			√		√		
CLO2					√								√	√	√			√	√		
CLO3									√				√		√					√	√

Indicate the relevancy between the CLO and PO by ticking "√" on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)
1	Group working skills
2	Mathematical modeling Skills

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F) L	T	P	O	Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT)
Chapter 1: Magnetics 1.1: Introduction to magnetics and Field Properties	CLO1	1	1.5				1	3.5
1.2: Magnetic Materials, Saturation, Hysteresis and Magnetic Circuits	CLO1	1	2				1	4.5
1.3: Iron loses and Production of EMF, Induced Force and Torque	CLO1	1	2				1	4
Chapter 2: Transformers 2.1: Introduction, Construction and Principle of operation	CLO1	1	2				1	4

	2.2: Ideal and practical models of Transformers	CLO1	2	2				1	5
	2.3: Transformer Tests: Short Circuit and Open Circuit tests	CLO3	1	3	6			2	12
	2.4: Three- phase transformers	CLO1 CLO3	1	3	3			1.5	8.5
	Chapter 3: Three-Phase Induction Machines: 3.1: Introduction, Construction and Principle of Operation	CLO1	2	3				2	7
	3.2: Synchronous Speed, Slip and Revolving Field	CLO1	2	3				1	6
	3.3: Equivalent circuit models and Power Loss in an Induction Motor	CLO1 CLO2	2	3				1	6
	3.4: Thevenin's Theorem and Torque-speed characteristics	CLO1 CLO2	2	3				1.5	6.5
	3.5: Torque equation, efficiency, and Determine Parameter of the equivalent circuit	CLO2	2	3	3			1	9
	3.6: Starting and Speed Control of 3 phase IM	CLO3	2	3	8			1	14
	Chapter 4: DC Machines 4.1: Introduction, Construction, Commutation and Armature reaction	CLO1	2	3				2	7
	4.2: Characteristics of DC generators and DC motors	CLO2	2	2	3			0.5	7.5
	4.4: Starting and Speed Control of DC motors	CLO3	1	3	6			2	12
	Chapter 4: Synchronous Machines 5.1: Introduction, Construction and Principles of operation of Synchronous Machine	CLO1	2	3				2	7
	5.2: Motor operation of synchronous machine	CLO1	2	3				2	7
	Total		29	47.5	29			24.5	130hrs

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quize	5	2hrs	1hrs	3hrs
2	Tests	20	3hrs	2hrs	5hrs
3	Lab-report	5	1hrs	3hrs	4hrs
4	Assignments	10	1hrs	2hrs	3hrs
5	Project	10	1.5hrs	4.5hrs	6hrs
Total					**21hrs**
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	3	6hrs	**9hrs**
Grand Total SLT					**160hrs**

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non-Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Workshop
		2	Simulation Room
		3	Software
13	Textbook and reference:	1	G. Mullisa: Introduction to Electrical Machines ,1983
		2	J. Hindmarsh: Electrical Machines and their Applications,4^{th} edition,1984

		3	Kosow: Electric Machinery and Control, Prentice-Hall
		4	Siskind: Electrical Machines, McGraw-Hill
		5	B.L Theraja and A.K Theraja, Text book of electrical technology

2.17.2.25 Electrical Workshop Practices II

Addis Ababa Science and Technology University						
1	College: Electrical and Mechanical Engineering			Department: Electrical Engineering		
2	Course Category	Core Course		Course Code: ECEg3112		
	Course Name	Electrical Workshop Practice II				
3	Synopsis:	In this course we discuss about: Rewinding of transformers and Stator of three phase Squirrel cage Induction motor; starting and control of 3-phase Induction Motor, Explain and perform Computer maintenance and Repair of electrical apparatus coil (Relay coil)				
4	Name(s) of Academic Staff:	Tsehay Endris				
5	Semester and Year offered:	Semester:	I	Year:	4	
6	Credit Hour:	2				
7	Co-requisite:	ECEg4113 Electrical Machine I				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Explain electrical apparatus (Relay) coil and Features and properties of hardware components of PC				
	CLO2	Analyze 3-phase induction motor stator windings				
	CLO3	Perform Rewinding of transformers, Stator of three phase squirrel cage Induction motors, starting and control of 3-phase IM, Repair of electrical apparatus (Relay) coil and Computer maintenance				

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√	√											√					√			
CLO2			√										√				√		√		
CLO3									√						√					√	√

Indicate the *relevancy* between the CLO and PO by ticking "√" on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1	Group working skills
2	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Transformer Rewinding 1.1 Transformer design Parameters, Design of sheet pack and winding the coil	CLO3	1		6			1	8
1.2: Testing of the rewound transformer	CLO3			2			0.5	2.5
Chapter 2: Develop and Rewind Stator of 3-phase squirrel Cage Induction motors: 2.1: Three Phase Stator Winding, Single layer winding: (Concentric, Mush and Chain),	CLO2 CLO3	2		15			2	19
2.1: Double layer winding	CLO2 CLO3	1		2			1	4
2.3: Testing of the rewound stator	CLO3			2			0.5	2.5
Chapter 3: Starting and Speed Control of								

	three phase induction Motors								
	3.1: Starting of 3-phase IM	CLO3			5				5
	3.2: Speed control of 3-phase IM	CLO3			5				5
	Chapter 4: Repair of apparatus coil 4.1: Concept of apparatus coil and their purpose,	CLO1	1					1	2
	4.2: Design of former or press board of the apparatus coil and Winding of the apparatus coil,	CLO3			2			1	3
	4.3: Testing of the repaired apparatus coil	CLO3			1			1	2
	Chapter 5: Computer maintenance 5.1: Introduction to PC and its basic components, Features and properties of hardware components of PC	CLO1	1					1	2
	5.2: Electrical precautions that must be considered during troubleshooting,	CLO1	1					1	2
	5.3 Perform Computer maintenance	CLO3			3				
	Total		7		43			10	60hrs

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quize	5	1hr	1hr	2hrs
2	Tests	5	2hr	1hrs	3hrs
3	Lab-report	10	1hrs	2hrs	3hrs
4	Assignments	10	1hrs	2hrs	3hrs
5	Project	20	1hrs	3hrs	4hrs
Total					**15hrs**
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	3hrs	2hrs	**5hrs**
				Grand Total SLT	**80hrs**

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non-Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Workshop
		2	Simulation Room
		3	Software
		4	Computer Lab
13	Textbook and reference:	1	Electrical workshop practice II laboratory manual prepared by the instructor
		2	Hand book of Electrical motor control systems. U.S. Eswar.Tata McGraw-Hill.1990
		3	Basic shop practical in electrical engineering. Hans. Dhanpat Raiand Co. (PVT.) Ltd1999
		4	Induction motors-protection and starting. Viv Cohen. Johannesburg 2000, South Africa.
		5	Industrial electrical trouble shooting; Lynn Lundquist

2.17.2.26 Introduction to Communication Systems

Addis Ababa Science and Technology University			
1	College: Electrical and Mechanical Engineering		Department: Electrical and Computer Engineering
2	Course Category	Core Course	Course Code: ECEg4101
	Course Name	Introduction to Communication Systems	
3	Synopsis:	This course is intended to give a strong background on Communication Systems Engineering. It starts by introducing basic concepts of communication systems, and it contains in-depth study of analog communication systems such as: AM, PM, and FM modulation/demodulation techniques. It also introduces digital modulation techniques and data communication.	
4	Name(s) of Academic Staff:		
5	Semester and Year offered:	Semester: I	Year: 4
6	Credit Hour:	3	
7	Prerequisite/ Co-requisite:	ECEg3102: Applied Electronics II ECEg3105: Signals and System Analysis ECEg2110: Probability and Random Processes	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Explain the fundamental concepts of communication systems.	
	CLO2	Analyze Amplitude, Phase and Frequency Modulation/Demodulation techniques.	
	CLO3	Analyze Digital representation of signals and data communications techniques.	
	CLO4	Design a model for simple analog communication systems and simulate in different platforms like MATLAB, Simulink… etc.	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√				√	√			
CLO2		√											√	√	√	√	√	√	√	√	√
CLO3		√											√	√	√	√	√		√		
CLO4			√												√	√				√	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Simulation skills using MATLAB, Simulink, … etc.
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			

	Chapter 1: Introduction to Communication Systems 1.1 Introduction 1.2 Elements of Communication Systems 1.3 Types of Communication Systems 1.4 Modulation and Multiplexing 1.5 Radio Wave Propagation Modes 1.6 The Electromagnetic Spectrum 1.7 Some Application Areas of Communication Systems	1	2hr				1hr	1hr	4hr
	Chapter 2: Analysis and Transmission of Signals 2.1 Review of Fourier Transform and Its Properties 2.2 Fourier Transform of Some Common Signals 2.3 Energy and Power Signals 2.4 Power Spectral Density	1, 2	4hr	2hr			1hr	2hr	9hr
	Chapter 3: Amplitude Modulation and Demodulation 3.1 Introduction 3.2 Basic Concepts of Amplitude Modulation 3.3 Frequency Spectrum and Bandwidth of AM Wave 3.4 Power content of AM Wave 3.5 Modified Forms of Amplitude Modulation 3.6 AM Transmitter and Receiver Circuits 3.7 Demodulation of AM Wave 3.8 Frequency Division Multiplexing (FDM)	2, 4	8hr	4hr	4hr	3hr	2hr	8hr	29hr
	Chapter 4: Angle Modulation and Demodulation 4.1 Introduction 4.2 Basic Concepts of Angle Modulation 4.3 Frequency Spectrum and Bandwidth of Angle Modulated Wave. 4.4 Comparison of FM and AM 4.5 Narrow Band and Wideband Frequency Modulation 4.6 Generation Techniques of FM Signals 4.7 Commercial AM and FM Broadcasting	2, 4	6hr	3hr	4hr	2hr	2hr	6hr	23hr

	Chapter 5: Digital Representation and Transmission of Analog Signals 5.1 Introduction 5.2 Analog to Digital Conversion 5.3 Line Coding and Waveform Shaping 5.4 Overview of Digital Modulation Techniques 5.5 Time Division Multiplexing (TDM) and Digital Carrier Systems	3	4hr	2hr	2hr	2hr	1hr	5hr	16hr
	Chapter 6: Introduction to Data Communication 6.1 Introduction 6.2 Modes of Data Transmission 6.3 Components of Data Communication 6.4 Types of Data Communication Networks 6.5 Network Models	3	4hr	2hr		4hr	1hr	5hr	16hr
	Total		28hr	13 hr	10 hr	11hr	8hr	27hr	**97hrs.**

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Assignments	5%		√	3hr
2	Quiz	5%	√		1hr
3	Tests	20%	√		4hr
4	Lab-report	8%		√	5hr
5	Project	12%	√	√	7hr
				Total	**20hr**

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50%	√		3hr
			Grand Total SLT	**120hrs.**

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Workshop: Communication Lab
		2	Software: MATLAB, Simulink, Multisim
		3	Computer Lab: For simulation purposes, and mini-project
13	Textbook and reference:	1	Louis E. Frenzel Jr., "*Principles of Electronic Communication Systems*", 4th Edition, 2016
		2	B. P. Lathi, Zhi Ding, "*Modern Digital and Analog Communication Systems*", 4th edition, 2009.
		3	Simon Haykin, "*Communications Systems*", 4th edition, 2001.
		4	Herbert Taub and Donald L. Schilling, "*Principles of Communications Systems*", 2nd edition.
		5	Leon W. Couch, "*Digital and analog Communications Systems*", 8th edition, 2013.

2.17.2.27 Computer Architecture and Organization

Addis Ababa Science and Technology University			
1	College: Electrical and mechanical engineering		Department: Electrical and computer engineering
	Course Name	Computer Architecture and Organization	
	Course Code:	ECEg4103	
3	Synopsis:	This course introduces students to the organization and architecture of computer systems, beginning with the standard von Neumann model and then moving forward to more recent architectural concepts. **General Introduction**: Organization and architecture, computer evolution, measuring performance, models of a computer system; **The Central Processing Unit**: Computer arithmetic, Instruction sets, Instruction format and addressing modes, RISC and CISC, Pipelining, The Control Unit (Hardwired and Micro-programmed Implementations); assembly/machine language programming; **Memory Systems**: Classification and hierarchy of Memory systems, Main memory, Cache Memory, Secondary Memory, Other types of memory, Memory Management I/O and interrupts; **Input Output Systems**: Input Output devices, modes of transfer, I/O interface, Techniques used for I/O Operations: Programmed, Interrupt-driven, Direct Memory Access;	
4	Name(s) of Academic Staff:	Yonas Tesfaye Yonas.tesfaye@aastu.edu.et	
5	Semester and Year offered:	Semester: I	Year: 4th
6	Credit Hour:	3	
7	Prerequisite/ Co-requisite:	Digital logic design (ECEg3104)	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Explain and identify the basic building blocks, the historical development, and performance assessment of computers.	
	CLO2	Explain the central processing unit, identify its components	
	CLO3	Explain and differentiate different types of instruction sets and addressing modes	
	CLO4	Explain and identify processor structure and function	
	CLO5	Explain and describe the components, functions, interconnection structures of computers	
	CLO6	Identify and apply the main types memory, the role and the design principles of catch memory	
	CLO7	Explain and identify the I/O modules and direct memory access	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignme	Project	Lab-report
CLO1	✓												✓				✓				
CLO2		✓											✓	✓			✓		✓		
CLO3		✓											✓	✓			✓		✓		
CLO4		✓											✓	✓			✓		✓		
CLO5		✓											✓	✓			✓		✓		

	CLO6			✓										✓	✓			✓		✓		
	CLO7		✓											✓	✓			✓				
	Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box																					

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Computer evolution and performance 1.1 organization and architecture	CLO1	1					2	3
1.2 Structure and function of computer	CLO1	1					2	3
1.3 History of computer	CLO1	1					2	3
1.4 design for performance	CLO1	1					2	3
1.5 performance assessment	CLO1	1	1				2	4
Chapter 2: The central processing unit 2.1 The arithmetic and logic unit	CLO2	1					2	3
2.2 Integer representation	CLO2	1					2	3
2.3 Integer arithmetic's	CLO2	1					2	3
2.4 floating point representation and arithmetic	CLO2	2	1				2	5
Chapter 3: Instruction sets and addressing modes 3.1 Addressing modes	CLO3	1	1				3	4
3.2 X86 and ARM addressing modes	CLO3	1					3	4
3.3 Instruction formats	CLO3	2					3	5
3.4 X86 and ARM instruction formats	CLO3	1					3	4
3.5 Assembly language	CLO3	2	3				1	6
Chapter 4: Processor structure and function 4.1 processor organization	CLO4	1					3	4
4.2 register organization	CLO4	1	1				3	5
4.3 Instruction cycle	CLO4	1	1				3	5
4.4 Instruction pipelining	CLO4	2	2				1	5
Chapter 5: A top level of computer function and interconnection 5.1 Computer components	CLO5	1					3	4
5.2 Computer functions	CLO5	1	2				3	6
5.3 Interconnection structure	CLO5	1	1				3	5
5.4 Bus interconnection	CLO5	1	1				3	5
Chapter 6: Catch memory 6.1 Computer memory system overview	CLO6	1					3	4

	6.2 Catch memory principles	CLO6	1	1					2
	6.3 Elements of catch memory design	CLO6	2	2					4
	Chapter 7: I/O module 7.1 External devices	CLO7	1						1
	7.2 I/O modules	CLO7	1						
	7.3 Interrupt driven I/O	CLO7	1						1
	7.4 Direct memory access	CLO7	2	1					3
	7.5 I/O channels and processors	CLO7	2	1					3
	Total								106

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test	30	2	2	4
2	Assignment	20		4	4
3	Choose an item.				
4	Choose an item.				
5	Choose an item.				
				Total	8
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	3	5	8
				Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Computer lab
		2	Choose an item.
13	Textbook and reference:	1	Wiliam stallings, Computer architecture and organization,8th ed., 2009, • ISBN-10 : 0136073735 ISBN-13 : 978-0136073734
		2	M. Mano, Computer System Architecture, 3rd ed., Prentice Hall, 1993.
		3	V.C. Hamacher, Computer Organization, McGraw Hill,5th edition 2001 ASIN : B00866HBKM
		4	J.P.Hayes, Computer Architecture and Organization, McGraw Hill,2012 • ISBN-10 : 1259028569 ISBN-13 : 978-1259028564
		5	J.L. Hennessy, D.A. Patterson, Computer Organization and Design, Morgan Kaufmann,5th edition 2013, ISBN-10 : 0124077269 ISBN-13 : 978-0124077263

2.17.2.28 Introduction to Control Systems

Addis Ababa Science and Technology University		
1	College: Electrical and Mechanical Engineering	Department: Electrical and Computer Engineering

2	Course Category	Core Course
	Course Name	Introduction to Control Systems
	Course Code:	ECEg4153
3	Synopsis:	This course mainly provides students with the knowledge and skills required to the basic concept of control systems, mathematical modeling of physical system, characteristics of feedback and non-feedback system, time and frequency response analysis of control system. At last the students will able to design and analyze the stability of linear control systems,
4	Name(s) of Academic Staff:	Biruk T., Lidia H., Mahilet L., Hamdihun A.
5	Semester and Year offered:	Semester: I — Year: 4
6	Credit Hour:	3
7	Prerequisite/ Co-requisite: (if any)	Computational Method, Applied Electronics I

8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Understand the principles and concepts of control system
	CLO2	Apply and Analyze the mathematical modeling of Physical Systems
	CLO3	Analyze the response of control systems in time and frequency domain, and their stability
	CLO4	Design and evaluate linear control systems and apply MATLAB/Simulink
	CLO5	Work collaboratively on a team to successfully complete a group assignment & project.

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods L	T	P	O	Assessment Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√								
CLO2		√		√	√	√							√	√	√		√	√			√
CLO3	√	√		√	√	√							√	√	√		√		√		√
CLO4	√		√	√	√								√	√	√				√	√	√
CLO5	√								√						√				√	√	√

Indicate the relevancy between the CLO and PO by ticking "√" on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1	MATLAB/Simulink Software skill
2	Team work skill

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F) L	T	P	O	Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT) In hrs.
								120 hrs.

	Chapter 1: Introduction to Control Systems 1.1 History and Definition of Control System Engineering 1.2 Control System Configuration • Open loop control System • Closed loop control systems 1.3 Example of closed loop system & block diagram representation	1	2 hrs.				2 hrs.	1 hr.	5 hrs.
	Chapter 2: **Mathematical Modeling of Physical System** 2.1 Introduction to System concept 2.2 Review on Laplace transform 2.3 Physical system models of electrical, mechanical and Electro-mechanical systems 2.4 System representation • *Differential equation* • *Transfer function* • Transfer function • Block diagrams • Signal flow graph 2.5 Block diagram algebra and SFG	2	6 hrs.	2 hrs.	4 hrs.		4 hrs.	2 hrs.	18 hrs.
	Chapter 3: Time Domain Response Analysis of Control System 3.1 Introduction 3.2 Transient Analysis • 1st order, 2nd order and higher order systems. • Effect of derivative and integral term in transient response. 3.3 Steady State Analysis 3.4 Stability Analysis 3.5 The stability of linear feedback control system 3.6 Sensitivity & Robustness	3	6 hrs.	3 hrs.	6 hrs.		4 hrs.	3 hrs.	22 hrs.

	Chapter 4: Frequency Response Analysis 4.1 Introduction to frequency response 4.2 Frequency response plot 4.3 Performance specification in frequency domain 4.4 Stability Analysis in Frequency Domain 4.5 Closed loop response from open-loop frequency response 4.6 Correlation between frequency response and time domain response	3	6 hrs.	4 hrs.	7 hrs.		5 hrs.	5 hrs.	27 hrs.
	Chapter 5: Control System Design 5.1 Control system design approaches 5.2 The Root-Locus Method 5.3 Design in s domain (compensator design) 5.4 PID controller and Classical tuning Procedure (ZN method) 5.5 Cascade compensation network & Phase-Lead/Lag design using the Bode diagram	4,5	8 hrs.	5 hrs.	8 hrs.		5 hrs.	5 hrs.	31 hrs.
	Total		28 hrs.	14 hrs.	25 hrs.		20 hrs.	16 hrs.	103 hrs.

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	5	√		1 hr.
2	Tests	20	√		2 hrs.
3	Assignments	10		√	5 hrs.
4	Project	10		√	6 hrs.
5	Lab-report	5		√	3 hrs.
				Total	17 hrs.

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50 %	√		3 hrs.
			Grand Total SLT	123 hrs

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software: MATLAB/Simulink
		2	Computer Lab
		3	Simulation Room
13	Text book and reference:	1	Control Systems Engineering, by Norman S. Nise 6th Edition, John Wiley & Sons, Inc. Roland Burns,
		2	Modern Control System, Richard Dorf, 11th Edition, 2008
		3	Advanced Control Engineering,2001, by Butterworth-Heinemann.
		4	Feedback Control system Analysis and Synthesis by J.J. D'azzo
		5	Modern Control System Theory, Gopal, M. 2nd Edition, New Age International Publishers, New Delhi,1993
		6	Modern Control Engineering, by Ogata. K. 4th Edition, Printicel Hall Inc. New JERSEY,2002

		7	Theory and Problems of Feedback and control Systems, Schaum's Outlines, by Joseph J. Distifano, Mc-GRAW HILL1990
		8	Linear Feedback Control Analysis and Design with MATLAB, by Dingyu Xue, SIAM, Philadelphia ,2007

2.17.2.29 Electrical Measurement and Instrumentation

	Addis Ababa Science and Technology University		
1	College: Electrical and Mechanical Engineering	Department: Electrical and Computer Engineering	
2	Course Category	Core Course	
	Course Name	Electrical Measurement and Instrumentation	
	Course Code:	ECEg4107	
3	Synopsis:	This course mainly provides students with the basic operational principles and limitations of electrical and electronic instruments, sensors and transducers with their application, Signal conditioning and conversion, Output presentation, and instrument transformer.	
4	Name(s) of Academic Staff:	Biruk T., Lidia H., Mahilet L., Hamdihun A. and Mebaye B.	
5	Semester and Year offered:	Semester: II	Year: 3
6	Credit Hour:	3	
7	Prerequisite/ Co-requisite:	Fundamentals of Electrical Engineering (ECEg2102)	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Understand the principles and concepts of measurement and instrument	
	CLO2	Apply and Analyze measurement accuracy and Select an appropriate transducer for a measurement	
	CLO3	Analyze and evaluate application wise design of passive and active sensors/transducers	
	CLO4	Design and Evaluate signal conditioning and conversion and its interface circuits, output presentation and implement simple measurement circuit and energy meter	
	CLO5	Work collaboratively on a team to successfully complete a group assignment and project.	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												✓		✓		✓		✓		
CLO2		√											✓		✓		✓			✓	✓
CLO3		√											✓		✓		✓		✓		
CLO4													✓		✓					✓	✓
CLO5															✓				✓	✓	✓

Indicate the relevancy between the CLO and PO by ticking "√" on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Electrical signal measurement skill
	2	Electrical instrument design skill
	3…etc.	Software skill (LabVIEW/Multisim)
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			120 hrs.

	Chapter 1: General Principles of Measurement 1.4 Basic Concepts of Measurement 1.2 Performance Characteristics – Static and Dynamic 1.3 Noise and Interference in Instrumentations	1	3 hrs.				2 hrs.	1 hr.	6 hrs.
	Chapter 2: Sensors and Transducers and its Applications 2.1 Concepts of error and accuracy 2.2 Transducer types and applications 2.3 Passive Sensors: Resistive, Capacitive, inductive and Active Sensors, Discrete Output Sensors: Shaft Encoders	2, 3	6 hrs.		12 hrs.		4 hrs.	4 hrs.	26 hrs.
	Chapter 3: Signal Conditioning and Conversion 3.1 Deflection Bridges 3.2 Amplifiers and Attenuators 3.3 Oscillators and Filters 3.4 Design Instrumentation Amplifier	3, 4	7 hrs.		12 hrs.		5 hrs.	4 hrs.	28 hrs.
	Chapter 4: Output Presentation 4.1 Indicators 4.2 Pointer-Scale display 4.3 Alphanumeric, Graphical representation 4.4 Recorders: Graphical, Magnetic, Semiconductor	4	5 hrs.		8 hrs.		4 hrs.	4 hrs.	21 hrs.
	Chapter 5: Instrument Transformer 5.1 1-Ø and 3-Ø Energy meter 5.2 CT and PT; testing and application,	1, 3, 4	4 hrs.		8 hrs.		5 hrs.	5 hrs.	22 hrs.
	Total		25 hrs.		40 hrs.		20 hrs.	18 hrs.	103 hrs.

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Assignments	10		✓	5 hrs.
2	Lab-report	5		✓	3 hrs.
3	Tests	15	✓		2.5 hrs.
4	Project	15		✓	6 hrs.
5	Quize	5	✓		0.5 hr.
				Total	17 hrs.

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	✓		3 hrs.
			Grand Total SLT	120 hrs.

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software
		2	Computer Lab
		3	Simulation Room
		4	Instrumentation lab
13	Textbook and reference:	1	J. B. Gupta: A Course in Electrical and Electronic Measurements and Instrumentation, 13th Edition, S.K Kataria and Sons, 2009.
		2	J.P. Bentley, Principles of Measurement Systems, 4th edition 2004.
		3	Robert B. Northrop: Introduction to Instrumentation and Measurements, Second Edition, CRC; 2 edition (June 28, 2005)
		4	U.A.Bakshi, A.V.Bakshi - Electrical Measurements and Instrumentation, Technical Publications, 2009.
		5	A. K. Sawhaney: A Course in Electrical Measurements Electronic Measurements and Instrumentation,11th Edition, Dhanpat Rai and Sons,1996
		6	by John G. Webster: The Measurement, Instrumentation and Sensors Handbook (Electrical Engineering Handbook), TF- CRC (December 29, 1998).
		7	IEEE–Transactions of Instrumentation and Control
		8	Video tutorials
		9	Webinars

2.17.2.30 Power Systems I

Addis Ababa Science and Technology University			
1	College: Electrical and Mechanical Engineering		Department: Electrical Engineering
2	Course Category	Core course	Course Code: ECEg4109
	Course Name	Power Systems I	
3	Synopsis:	This course introduces and explains fundamentals of electrical power systems design and engineering. Phasors and their application to power systems analysis are reviewed. The concept of the per-unit system is introduced and applied to circuit calculations. Transmission line parameters, their calculation, and transmission line modeling are introduced. Steady-state operation of transmission lines is modeled and investigated. Mechanical design aspect of overhead transmission line discussed. Brief introduction of underground cable construction and calculation of its insulation resistance is explained.	
4	Name(s) of Academic Staff:	Yared Tassew (MSc)	
5	Semester and Year offered:	Semester: I	Year: 4
6	Credit Hour:	3	
7	Prerequisite/ Co-requisite:	Electrical Machine I (ECEg4113)	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Apply the basic principles of circuit analysis and phasor representation to solve power flow in AC networks	
	CLO2	Represent power system components on one line and impedance diagram	
	CLO3	Define and Calculate the parameters of Transmission line	
	CLO4	Model and analyze the performance of an overhead transmission line	
	CLO5	Perform mechanical design overhead transmission line	
	CLO6	Explain the construction of underground cable and calculate their insulation resistant	

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√	√			√	√	√		√
CLO2		√											√	√			√				
CLO3	√												√	√	√		√				√
CLO4			√										√	√	√		√	√			√
CLO5			√										√	√		√	√		√		
CLO6								√					√	√			√				

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)		
	1	Matlab programing	
	2		
	3…etc.		
11	Distribution of Student Learning Time (SLT)		
		Teaching and Learning Activities	Total

	Course Content Outline	CLO	Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	(SLT)
			L	T	P	O			
	Chapter 1: Fundamentals of Power systems 1.1 Introduction	1	3	2	9			7.5	21.5
	1.2 AC and DC transmission								
	1.3 Complex power								
	1.4 Power triangle								
	1.5 Direction of power flow								
	1.6 power in balanced 3phase circuit								
	1.7 power factor correction								
	1.8 per unit quantity								
	Chapter 2: Representation of power system components 2.1 Introduction	2	1.5	0.5				2.5	4.5
	2.2 Circuit Model power transformer								
	2.3 Circuit Model of synchronous generator								
	2.4 Circuit Model transmission line								
	2.5 Circuit Model of load								
	2.6 One-Line Diagram, Impedance Diagram and reactance diagram								
	Chapter 3: Transmission line parameters 3.1 Resistance of transmission lines - skin effect and proximity effect	1,3	4.5	3	3			7	17.5
	3.2 Inductance of transmission line								
	3.3 Capacitance of transmission line - Ferranti effect								
	Chapter 4: Characteristic and performance of power transmission lines 4.1 Representation transmission line: Short, medium and long transmission lines	1,4	4.5	2	6			6	18.5
	4.2 ABCD constants								
	4.3 Steady- state performance – efficiency and regulation								
	Chapter 5: Mechanical design of transmission lines 5.1 Sag and tension calculations	5	3	1.5				4.5	9
	5.2 effect of wind and ice								
	5.3 stringing chart and sag template.								
	Chapter 6: Corona	5	1.5	1				2.5	5

	6.1 Disruptive critical voltage 6.2 Corona loss 6.3 Line design based on corona 6.4 Advantages and disadvantages of corona								
	Chapter 7: Overhead line insulators 7.1 Types of insulator 7.2 potential distribution over a string of insulators 7.3 methods of equalizing potential	5	2.5	1.5		3		4.5	11.5
	Chapter 8: Underground cables 8.1 construction of cables 8.2 Types of cables 8.3 Cables for 3-Phase Service 8.4 Insulation Resistance of a Single-Core Cable	1,6	2.5	1				3	6.5
	Total		23	12.5	18	3		37.5	94

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	5	1	1	2
2	Tests	15	2	3	5
3	Assignments	15	1	3	4
4	Lab-report	15	1	3	4
				Total	16

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	3	7	10
			Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Power System Lab
		2	Computer Lab
		3	Matlab software
13	Textbook and reference:	1	John Grainger and William Stevenson: Power System Analysis, McGraw-Hill Science/Engineering/Math; 3rd t ed. 2015
		2	C. L. Wadhawa, Electrical Power Systems, New Age International Publishers, 7th ed, 2017
		3	By V K Mehta And Rohit : Principles of Power System , All Electrical Engineering books by SChand Publications
		4	Arthur R. Bergen and Vijay Vittal: Power Systems Analysis, Prentice Hall; 2nd ed., 1999
		5	J. D. Glover and M. S. Sarma, Power System Analysis and Design, Brooks/Cole, 6th Edition.

2.17.2.31 Integrated Engineering Team Project

Addis Ababa Science and Technology University						
1	College: Electrical and Mechanical Engineering		Course Owner: Mechanical Engineering			
2	Course Category	University Requirement				
	Course Name	Integrated Engineering Team Project				
	Course Code:	IETP4115				
3	Synopsis:	This is a multidisciplinary team integrated engineering project in connection with a special engineering problem and under the guidance of a faculty member. The project synopsis consists of literature review, design, project management, business acumen, multidisciplinary team work, entrepreneurship				
4	Name(s) of Academic Staff:	To be assigned				
5	Semester and Year offered:	Semester:	I	Year:	4	
6	Credit Hour:	3				
7	Prerequisite/ Co-requisite: (if any)	-				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to :					
	CLO1	Apply engineering knowledge and solve engineering design problem.				
	CLO2	Work in a multi-disciplinary team-based engineering project work.				
	CLO3	Apply the principle of project management.				
	CLO4	Apply proper design process to produce creative and innovative solution.				
	CLO5	Demonstrate effective communication, report writing, presentation and entrepreneur skills.				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assign	Projec
CLO1		√													√	√				√
CLO2										√					√	√				√
CLO3				√								√			√	√				√
CLO4					√	√									√	√				√
CLO5										√		√			√	√				√
Indicate the relevancy between the CLO and PO by ticking “√”on the appropriate relevant box																				

<table>
<tr><td rowspan="4">10</td><td colspan="5">Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)</td></tr>
<tr><td>1</td><td colspan="4">To develop team spirit and leadership skills as well as technical competency in delegation of various tasks, analyzing engineering problems, performing engineering design and enhancing software related skills</td></tr>
<tr><td>2</td><td colspan="4">Develop skills of integrating components into a comprehensive working system.</td></tr>
<tr><td>3</td><td colspan="4">Gain Project management skills.</td></tr>
<tr><td rowspan="15">11</td><td colspan="5">Subject Planning</td></tr>
<tr><td colspan="2" rowspan="2">Project Activity</td><td colspan="3">Hours</td></tr>
<tr><td>Lect.</td><td>Tut.</td><td>Lab (Practical)</td></tr>
<tr><td colspan="2">Introduction
▪ Entrepreneurship, Business Plan, Cash Flow, Contracting works, marketing strategy
▪ Project Management, project evolution and review techniques (PERT) etc.</td><td>10</td><td></td><td></td></tr>
<tr><td colspan="2">▪ Project proposal</td><td></td><td></td><td>20</td></tr>
<tr><td colspan="2">▪ Project planning and Design
▪ Design
▪ Project costing
▪ Resource scheduling
▪ Project cash flow
▪ Development
▪ Economic analysis
▪ Assembly/Production Drawings</td><td></td><td></td><td>80</td></tr>
<tr><td colspan="2">▪ Project Report</td><td></td><td></td><td>8</td></tr>
<tr><td colspan="2">▪ Project presentation</td><td></td><td></td><td>2</td></tr>
<tr><td colspan="3">Total Hours</td><td></td><td>120</td></tr>
<tr><td colspan="5">Assessment</td></tr>
<tr><td colspan="2">Project proposal</td><td colspan="3"></td></tr>
<tr><td colspan="2">Project Fabrication</td><td colspan="3"></td></tr>
<tr><td colspan="2">Project report</td><td colspan="3"></td></tr>
<tr><td colspan="2">oral presentation</td><td colspan="3"></td></tr>
<tr><td colspan="2">Poster evaluation</td><td colspan="3"></td></tr>
<tr><td rowspan="4">13</td><td rowspan="4">Reference:</td><td>1</td><td colspan="3">Faculty Members</td></tr>
<tr><td>2</td><td colspan="3">Journal on appropriate topics</td></tr>
<tr><td>3</td><td colspan="3">Related books</td></tr>
<tr><td>4</td><td colspan="3">Internet sources
IETP Guidelines</td></tr>
</table>

2.17.2.32 Microprocessors and Interfacing

Addis Ababa Science and Technology University		
1	College: Electrical and mechanical	Department: Electrical and computer engineering
	Course Name	Microprocessors and Interfacing
	Course Code:	ECEg4102
3	Synopsis:	This course is designed to impart in-depth knowledge in the design, programming and organization of microcomputers and interfacing circuits. This course completely covers the popular Intel µP 8086, which would be a stepping-stone for learning the X 86 families of microprocessors. Fundamentals of Microprocessors and Microcontrollers Architecture; Register level organization; Memory organization; Bus systems; Peripheral hardware organization; Instruction Set; Assembly language programming: C programming; Microcontroller programming starting from the architecture to all its peripherals; Different applications of microcontroller in real world, lower level communication protocols for microcontrollers; Interfacing Fundamentals; Programmable Interrupt Controller (PIC); Programmable Peripheral Interface (PPI).
4	Name(s) of Academic Staff:	Yonas Tesfaye Yonas.tesfaye@aastu.edu.et
5	Semester and Year offered:	Semester: II Year: 4th
6	Credit Hour:	4
7	Prerequisite/ Co-requisite:	Computer architecture and Organization (ECEg4103)
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Explain microprocessors and microcontrollers with their differences
	CLO2	Identify the architecture of 8086 microprocessors and use the instruction sets for the assembly program of X86 family processors.
	CLO3	Apply and develop C program for the programming of different types of microcontrollers
	CLO4	Apply the knowledge of different peripherals to program a microcontroller.
	CLO5	Identify and Apply the knowledge of different peripherals on board with the microcontroller in the programming of controllers
7	CLO6	Design and build a system using a microcontroller based on the requirements given.
8	CLO7	Apply and use low level communication protocols for the communication of microcontroller with other peripherals.
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√				√				
CLO2		√											√	√	√		√		√		
CLO3					√								√	√	√		√		√		
CLO4					√								√	√	√		√		√		
CLO5					√								√	√	√		√		√		
CLO6			√										√	√	√		√		√		
CLO7				√											√					√	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	

	1								
	2								
	3…etc.								
11	Distribution of Student Learning Time (SLT)								
	Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT)
			L	T	P	O			
	Chapter 1: Introduction 1.1 Building blocks of digital computer and their uses	CLO1	0.5						0.5
	1.2 History of microprocessors	CLO1	0.5						0.5
	1.3 The reason behind microprocessor technology	CLO1	0.5						0.5
	1.4 The function of microprocessors	CLO1	0.5						0.5
	1.5 Differences of microprocessor and microcontroller	CLO1	0.5						0.5
	Chapter 2: Architecture and Instruction set of 8085 and 8086 2.1 Building blocks of microprocessors	CLO2	1						1
	2.2 The ALU, Registers, Control unit, Internal clock and Internal data busses of the microprocessors	CLO2	1	1					2
	2.3 The data and address busses of 8085/86	CLO2	0.5						0.5
	2.3 Von Neumann and Harvard architecture of microprocessors	CLO2	0.5						0.5
	2.4 Data and program memory organizations of 8085/8086	CLO2	0.5						0.5
	2.5 Memory address generation of 8086	CLO2	0.5						0.5
	2.6 8085/86 pin functions	CLO2	0.5						0.5
	2.7 Peripherals interfaced with 8086 processors ➢ Memory ➢ Ports ➢ Timer ➢ Interrupts	CLO2	2	1					3
	2.8 Instruction set of 8085/8086 ➢ Instruction size ➢ Execution speed ➢ Available instruction ➢ Addressing modes	CLO2	1	1					2
	2.9 RISC and CISC processors	CLO2	0.5						0.5

	2.10 Assembly programming	CLO2	1	2	2				5
	2.11 Assembly programming with 8086 emulator	CLO2	3	3	2				8
	Chapter 3: C for microcontrollers programming 3.1 C programming IDE (MPLAB X IDE)	CLO3 CLO4	2	2	2				6
	3.2 C compiler	CLO3	0.5						0.5
	3.3 Basic C programming structure ➢ Microcontroller header files ➢ Compiler data types ➢ Different types of variables ➢ Arithmetic operations ➢ Bit parallel logical operations ➢ Shift and relational operations ➢ Structures • If-then-else • Switch • While and do while • For ➢ Functions ➢ Arrays ➢ Pointers	CLO3	2	4	6			2	12
	Chapter 4: Introduction to microchip microcontrollers (PIC 18F) 4.1 Architecture of PIC 18F microcontrollers	CLO3 CLO4	2						2
	4.2 Memory organizations	CLO3 CLO4	0.5	1	1				2.5
	4.3 Oscillator configurations	CLO3 CLO4	0.5	2	1				3.5
	4.4 I/O ports	CLO3 CLO4	1	2	1				4
	4.5 Interrupts	CLO3 CLO4	1	2	2			1	6
	4.6 Timers	CLO3 CLO4	1	2	2			1	6
	4.7 PWM	CLO3 CLO4	1	2	2			1	6
	4.8 ADC	CLO3 CLO4	1	2	2			1	6
	4.9 Comparator	CLO3 CLO4	1	2	2			1	6
	4.10 Instruction sets	CLO3 CLO4	1	2	2				5
	Chapter 5: Applications of microcontrollers 5.1 4 bit up and down counter with LED	CLO3 CLO4 CLO5 CLO6	1	2	1				5

	5.2 2 seconds on/off LED using timers and interrupts	CLO3 CLO4 CLO5 CLO6	1	2	2			1	6
	5.3 Sensor value display on LEDs using ADC conversion and interrupts	CLO3 CLO4 CLO5 CLO6	1	2	3			2	8
	5.4 DC motor control using PWM	CLO3 CLO4 CLO5 CLO6	1	2	3			2	8
	Chapter 6: Communication between peripherals or microcontrollers 6.1 Streaming parallel port	CLO7	1	1	2			1	5
	6.2 Serial peripheral interface (SPI)	CLO7	1	1	3			1	6
	6.3 Universal Synchronous asynchronies receiver and transmitter (USART)	CLO7	1	1	3			1	6
	Total		36	4 2	42			13	133

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test	20	2	2	4
2	Assignment	20		4	4
3	Project	30		10	10
4	Choose an item.				
5	Choose an item.				
				Total	20
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		30	3	4	7
				Grand Total SLT	

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software's
		2	Computer lab, Company visit
		3	Electronic devices like sensors, controllers, and motors.
13	Textbook and reference:	1	Douglas V Hall, 'Microprocessors and Interfacing-Programming and Hardware', 2nd Edition, Tata McGraw-Hill Publishing Company Limited, NewDelhi-2002.
		2	Ramesh S Gaonkar, 'Microprocessor Programming and Interfacing using 8085', Penram Publications, 4th Edition, 2003
		3	A.K.Ray, K.M.Bhurchandy, 'Intel Microprocessors-Architecture, Programming and Interfacing', McGraw-Hill International Edition, 2004.

2.17.2.33 Integrated Design Project

Addis Ababa Science and Technology University		
1	College: Electrical and mechanical engineering	Department: electrical and computer engineering
	Course Name	Integrated Design Project
	Course Code:	ECEg4112
3	Synopsis:	This Integrated Design Project is either a group-based (up to 3) or individualized engineering design project to evaluate the overall knowledge of the student(s) before going for the BSc Thesis. If it is an individualized project the student will be evaluated on the basis of his/her understanding, application and presentation of basic computing knowledge and skills. If it is a group-based project each student will also be evaluated its role in the group work and its team work dimensions.
4	Name(s) of Academic Staff:	Dr. Asrat Mulatu **asrat.mulatu@aastu.edu.et**
5	Semester and Year offered:	Semester: I Year: 5
6	Credit Hour:	3
7	Prerequisite/ Co-requisite:	Senior standing
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Identify computing problems that can solve critical societal and industrial problem, and that has economic value.
	CLO2	Solve novel computing problems using educational and industry standard tools and techniques.
	CLO3	Design and develop novel solutions for identified problems by applying basic and advanced knowledge.
	CLO4	Illustrate, articulate, write and defend what has been designed, implemented and tested in a professional and coherent manner.
	CLO5	Criticize the short and long term impact of the project process and product from various dimensions.
	CLO6	Play a team and individualized role in planning, executing, communicating and sharing work processes in the project timely and discretely.
	CLO7	Plan how the process and the product of the project can be used and capitalized for lifelong benefits of various dimensions.
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignme	Project	Lab-report
CLO1	√														√	√				10	
CLO2		√													√	√				15	
CLO3			√												√					15	
CLO4					√										√					15	
CLO5							√								√	√				15	
CLO6									√						√	√				15	
CLO7												√			√					15	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	

11	Distribution of Student Learning Time (SLT)								
	Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT)
			L	T	P	O			
	Identify existing problems in the community or in industry	CLO1				10	8		18
	Project proposal preparation	CLO1 CLO2			5		4		9
	Design and develop the project	CLO3 CLO4 CLO5 CLO6			40		10		50
	Testing	CLO5 CLO7			10		8		18
	Demonstration and paper work	CLO5 CLO6 CLO7			5		4		9
	Total								104

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Proposal Report	20	2	2	4
2	Progress Reports	20	2	2	4
3	Technical Report (Individual)	20	2	2	4
4	Final Report and Peer Evaluation	40	2	2	4
				Total	16

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	0			0
			Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Project lab /embedded systems lab
		2	Electronic equipment's like sensors, motors, controllers
		3	Software's like MPLAB
13	Textbook and reference:	1	Depends on the nature project system requirements

2.17.2.34 Industry Internship

	Addis Ababa Science and Technology University	
1	College: Electrical and mechanical engineering	Department: electrical and computer engineering
	Course Name	Industry Internship
	Course Code:	ECEg4100
3	Synopsis:	The Students must be attached with an industry for at least five months in order to get real world experience in their field of study, which compliments their education. The student and the internship coach at the industry have to submit a report on the attachment program, which is evaluated at the departmental committee with pass or fail grade.
4	Name(s) of Academic Staff:	Yonas Tesfaye **yonas.tesfaye@aastu.edu.et**
5	Semester and Year offered:	Semester: Summer Year: 4th
6	Credit Hour:	6
7	Prerequisite/ Co-requisite:	Senior standing
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Apply theories from different courses doing real project.
	CLO2	Construct and develop well-scoped and devised projects.
	CLO3	Design and develop novel solutions for identified problems by applying basic and advanced knowledge.
	CLO4	Illustrate, articulate, write and defend what has been designed, implemented and tested in a professional and coherent manner.
	CLO5	Criticize the short and long term impact of the project process and product from various dimensions.
	CLO6	Play a team and individualized role in planning, executing, communicating and sharing work processes in the project timely and discretely.
	CLO7	Plan how the process and the product of the project can be used and capitalized for life long benefits of various dimensions.
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1			√												√	√				10	
CLO2			√												√	√				15	
CLO3			√												√					15	
CLO4					√										√					15	
CLO5							√								√	√				15	
CLO6									√						√	√				15	
CLO7												√			√					15	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	
11	Distribution of Student Learning Time (SLT)	
		Teaching and Learning Activities | Total

	Course Content Outline	CLO	Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	(SLT)
			L	T	P	O			
	Industry work								
	Total								231

	Assessment				
	Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
	1	Presentation	20	2	2	4
	2	Industry Reports	40	0	0	0
	3	Technical Report (Individual)	20	0	4	4
	4	Examiner evaluation	20	1	0	1
					Total	9
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		0			0
					Grand Total SLT	240

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course (e.g., software, computer lab, simulation room …etc.)	1	Workshop
		2	
		3	
13	Textbook and reference:	1	Depends on the nature project system requirements

2.17.2.35 Industrial Management and Engineering Economy

Addis Ababa Science and Technology University			
1	College: Electrical and Mechanical Engineering		Department: Mechanical Engineering
2	Course Category	Core Elective/focused Area	
	Course Name:	Industrial Management and Engineering Economy	
	Course Code:	IEng5104	
3	Synopsis:	Basics of management and functions of management; basics of plant layout, ergonomics and industrial safety; defining forecasting and the use of forecasting techniques; inventory management and control; basics of project management and resource allocation; project crashing and project risks; time value of money and cash flow; present and future worth of investments; basic concepts and computations of depreciation; cost comparison of alternative investments; accounting and budgeting fundamentals.	
4	Name(s) of Academic Staff:		
5	Semester and Year offered:	Semester: II	Year: V
6	Credit Hour:	3	
7	Prerequisite/ Co-requisite:	Economics (Econ2009)	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Describe the basic functions of management and the basic requirements/types of organizational structure	
	CLO2	Creating ergonomic working environment using plant design principles	
	CLO3	Apply the different forecasting techniques for appropriate engineering applications	
	CLO4	Define the basics of project management and resource allocation in projects	
	CLO5	Apply different principles of accounting and industrial economics for comparing alternative investments	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Seminar	Assignment	Lab-report
CLO1	√												√	√			√	√		√	
CLO2						√							√	√			√			√	
CLO3				√									√	√						√	
CLO4	√												√	√						√	
CLO5				√																	

10	Indicate the relevancy between the CLO and PO by ticking “√”on the appropriate relevant box	
	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Teamwork
	2	Project management
	3…etc.	Act economically
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities			Total (SLT)
		Guided learning (F2F)	Guided Learning (NF2F)	Independent Learning (NF2F)	

			L	T	P	O			
	Chapter 1: Basic Management Concepts and Industrial Organization 1.1 Introduction to management 1.2 Functions of management 1.3 Organizational structure 1.4 Basics of productivity	CLO1	3	-	-	-	-	-	3
	Chapter 2: Plant Design 2.1 Basics of Plant Layout 2.2 Study of Plant Layout 2.3 Ergonomics and Industrial Safety	CLO2	6	-	-	6	4	2	18
	Chapter 3: Forecasting 3.1 Meaning and use of forecasting 3.2 Forecasting techniques	CLO3	6	-	-	-	4	2	12
	Chapter 4: Materials Management 1.1 Purchasing 1.2 Inventory Control	CLO4	4	-	-	4	2	-	10
	Chapter 5: Project Management and Resource Allocation 1.1 Work breakdown structure 1.2 Project organization 1.3 Network scheduling 1.4 Projects crashing 1.5 Resource allocation 1.6 Project risks	CLO4	6	-	-	6	4	3	19
	Chapter 6: Engineering Economics and Depreciation 6.1 Time Value of Money 6.2 Cash Flow/Cash Flow Diagram 6.3 Present Worth and Future Worth 6.4 Interest Rates/Interest Period 6.5 Basic Concepts of depreciation 6.6 Depreciation Computation Methods		6	-	-	-	-	2	8
	Chapter 7: Cost Comparison of Alternative Methods and Investment Evaluation: 7.1 Cost Comparison Techniques 7.2 Present Worth of Costs 7.3 Capitalized Costs 7.4 Equivalent Uniform Annual Costs 7.5 Total investment costs 7.6 Projects financing 7.7 Financial evaluations	CLO5	6	-	-	2	3	2	13
	Chapter 8: Basic Accounting Principles and Budgeting Fundamentals 8.1 Classification of accounts 8.2 Accounting concepts	CLO6	3	-	-	2	3	2	10

	8.3 Accounting statements 8.4 Budgets and budgetary control								
	Total		40	-	-	20	20	13	**93**

Assessment				
Continuous Assessment	Percentage Total-50(%)	F2F	NF2F	SLT
1 Quiz	10	1	-	1
2 Tests	15	2	-	2
3 Assignments	25	-	3	15
			Total	**18**
Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	3	6	**9**
			Grand Total SLT	**120**

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room …etc.)	1	---
		2	Choose an item.
		3	Choose an item.
13	Text book and reference: (note: ensure the latest edition /publication)	1	Daniel Kitaw, (2007). Industrial Management and Engineering Economics, Addis Ababa University Press
		2	Heizer, Jay and Render, Barry: Operation Management, 8th ed, 2006.
		3	Mikell P. Groover, Automation, Production systems, and Computer Integrated Manufacturing , 5th Edition, Asia, Pearson Education, 2019

2.17.2.36 Final Year Project

	Addis Ababa Science and Technology University				
1	College: Electrical and mechanical engineering		Department: electrical and computer engineering		
2	Module Category		Module Code:		
	Module Name				
	Course Code:	ECEg518			
3	Synopsis:	Success of the project is determined in large part by whether students have adequately solved the problem that they are working on.			
4	Name(s) of Academic Staff:	Yonas Tesfaye yonas.tesfaye@aastu.edu.et			
5	Semester and Year offered:	Semester:	II	Year:	6th
6	Credit Hour:	6			
7	Prerequisite/ Co-requisite:	All senior standing courses			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Apply theories from different courses doing real project.			
	CLO2	Construct and develop well-scoped and devised projects.			
	CLO3	Design and develop novel solutions for identified problems by applying basic and advanced knowledge.			
	CLO4	Illustrate, articulate, write and defend what has been designed, implemented and tested in a professional and coherent manner.			
	CLO5	Criticize the short and long term impact of the project process and product from various dimensions.			
	CLO6	Play a team and individualized role in planning, executing, communicating and sharing work processes in the project timely and discretely.			
	CLO7	Plan how the process and the product of the project can be used and capitalized for life long benefits of various dimensions.			
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:				

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1			√												√	√				10	
CLO2			√												√	√				15	
CLO3			√												√					15	
CLO4					√										√					15	
CLO5							√								√	√				15	
CLO6									√						√	√				15	
CLO7												√			√					15	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	
11	Distribution of Student Learning Time (SLT)	

	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	Project				200			30	221
	Total								231

	Assessment				
	Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Presentation	20	2	2	4
2	Advisor	40	10	0	10
3	Technical Report (Individual)	20	0	4	4
4	Examiner evaluation	20	1	0	19
				Total	9

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	0			0
			Grand Total SLT	240

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Laboratory work
		2	
		3	
13	Textbook and reference:	1	Depends on the nature project system requirements

2.17.3 Communication Engineering Focus Area Courses

2.17.3.1 Digital Communications System

Addis Ababa Science and Technology University						
1	College: Electrical and Mechanical Engineering		Department: Electrical Engineering			
2	Course Category	Core Module	Course Code: ECEg 4304			
	Course Name	Digital Communications System				
3	Synopsis:	This course is intended to give a strong background on principle of digital communication systems, information theory and coding, digital modulation techniques, noise in digital modulation, spread spectrum communication, MIMO and OFDM systems.				
4	Name(s) of Academic Staff:					
5	Semester and Year offered:	Semester:	II	Year:	4	
6	Credit Hour:	3				
7	Prerequisite/ Co-requisite:	Introduction to Communications System (ECEg4101)				

8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Analyze the performance of digital communication system in terms of error rate, spectral efficiency, and power efficiency.
	CLO2	Select blocks, laboratory and simulation tools in design of digital communication system
	CLO3	Design optimum receivers for digital communication
	CLO4	analyze spread spectrum communication
	CLO5	Analyze OFDM and MIMO systems
	CLO6	Develop critical thinking skills by analyzing communication systems through associated laboratory activities

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
													Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1		√											√		√		√				√
CLO2					√										√						√
CLO3			√										√		√				√	√	√
CLO4		√											√				√		√	√	
CLO5		√											√		√		√				√
CLO6				√											√						√

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	

11	Distribution of Student Learning Time (SLT)					
	Course Content Outline	CLO	Teaching and Learning Activities			Total (SLT)
			Guided learning (F2F)	Guided Learning (NF2F)	Independent Learning (NF2F)	

			L	T	P	O			
	Chapter 1: Review of digital communication system 1.1: Review on Analog to Digital conversion 1.2: Elements of digital communication system 1.3: Merits and demerits of digital communication	2,6	2		6			3	11
	Chapter 2: Information theory and coding 2.1: Basics of information theory 2.2: Source coding 2.3: Channel coding 2.4: Error control coding	1	4					5	9
	Chapter 3: Digital Modulation Techniques 3.1: Message signal representation 3.2: Performance Parameters of Digital Communication 3.3: Phase Shift Keying (PSK) 3.4: Frequency Shift Keying (FSK) 3.5: Amplitude Shift Keying (ASK) 3.6: Quadrature Amplitude Modulation (QAM)	1,2,6	6		16		2	6	30
	Chapter 4: Optimum receiver design 4.1: Received Signal Representation 4.2: Design of optimum receivers for signals corrupted by additive white Gaussian noise 4.3: Performance of optimum receivers for digitally modulated signals in the presence of additive white Gaussian noise 4.4: Mitigating effects of ISI	3,6	5		7		2	6	20
	Chapter5: Spread Spectrum Communication Systems 5.1: model of spread spectrum digital communication system 5.2: Types of spread spectrum signals 5.3: synchronizations of spread spectrum systems	4	4				1	5	10
	Chapter 6: Introduction to Orthogonal Frequency Division Multiplexing (OFDM) system 6.1: Characteristics and principles of operation 6.2: Advantages and Disadvantages 6.3: Application Areas	5,6	4		5			4	13

	Chapter 7: Introduction to MIMO Communication 7.1: Main categories of MIMO and their principles 7.2: Applications	5,6	3		5			4	12
	Total		28		39		5	33	105

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	5	√		1
2	Assignments	10		√	2
3	Tests	15	√		2
4	Project	10		√	2
5	Lab-report	10		√	2
				Total	9

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	√		6
			Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software
		2	Computer Lab
		3	Simulation Room
13	Textbook and reference:	1	S. Haykin and M. Moher, Communication Systems, 5th Edition, John Wiley and Sons, 2009, ISBN: 978-0-471-69790-9.
		2	S. Haykin, Digital Communication Systems, Wiley, 2013, ISBN: 0471647357,9780471647355
		3	John G. Proakis, Masoud Salehi, Digital Communications, 5th Ed., McGraw-Hill, Inc., 2007, ISBN: 0-07-295716-6.
		4	Barry, Lee, and Messerschmitt, Digital Communication, 3rd Ed, Springer US, 2004.
		5	B.P.Lathi and Z. Ding, Modern Digital and Analog Communication Systems, 5th Edition, Oxford University Press, 2018.

2.17.3.2 EM Waves and Guide Structures

	Addis Ababa Science and Technology University		
1	College: Electrical and Mechanical Engineering		Department: Electrical Engineering
2	Course Category	Core Course	Course Code: ECEg4308
	Course Name	EM Waves and Guide Structures	
3	Synopsis:	This course introduces students to advanced electromagnetic phenomena which are used in wide range of applications; including wireless communications, circuits, computer interconnects and peripherals, optical fiber links and components, microwave communications and radar, antennas, sensors, etc. Topics covered include: Review of Vectors and Maxwell's Equations, Field Quantities; Maxwell's Equations; Boundary Conditions; Time-Harmonic Fields, Electromagnetic Wave Propagation, Waves in General; Wave Propagation in Lossy Dielectrics; Plane Waves in Free Space; Plane Waves in Lossless Dielectrics; Plane Waves in Good Conductors; Power and Poynting Vector, Poynting Theorem; Refection of Plane Wave at Normal and Oblique Incidence; Summary of TEM Waves, Transmission Lines , Transmission Line Equations; Input Impedance, SWR, and Power; The Smith Chart; Some Application of Transmission Lines, Waveguides: Rectangular Waveguides; TM Modes; TE Modes; Power Transmission and Attenuation; Waveguide Resonators	
4	Name(s) of Academic Staff:		
5	Semester and Year offered:	Semester: II	Year: 4
6	Credit Hour:	3	
7	Prerequisite/ Co-requisite:	ECEg3107: Electromagnetic Fields ECEg4101: Introduction to Communication Systems	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Evaluate the effects of accelerated charges in producing time-varying electromagnetic waves.	
	CLO2	Reframe the governing equations for EM wave propagation, RF transmission lines, rectangular waveguides and resonant cavities from Maxwell’s equations.	
	CLO3	Use and Interpret smith chart and matching techniques in analysis of transmission lines.	
	CLO4	Asses the application of electromagnetic waves and guides in communication engineering.	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignme	Project	Lab-report
CLO1	√												√	√				√	√		
CLO2		√											√	√			√		√		
CLO3				√									√	√			√		√		
CLO4		√											√	√			√		√		

Indicate the relevancy between the CLO and PO by ticking “√” on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	
11	Distribution of Student Learning Time (SLT)	
	Teaching and Learning Activities	Total (SLT)

	Course Content Outline	CLO	Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	Chapter 1: Introduction to Electromagnetic phenomena in modern applications 1.1. Electromagnet wave spectrum 1.2. Properties of electromagnetic wave in wired medium 1.3. Phenomenon of electromagnetic wave in wireless medium	1	2	3			1	2	8
	Chapter 2: Review of Vectors and Maxwell's Equations 2.1. Scalar and Vector Fields 2.2. Line, Surface, and Volume Integrals 2.3. Gradient of a Scalar field, Divergence and Curl of a Vector Field, Laplacian of a Scalar Field 2.4. The Divergence and Stokes's Theorems 2.5. Helmholtz's Theorem 2.6. Field Quantities 2.7. Maxwell's Equations, Boundary Conditions and Time-Harmonic Fields	1,2	4	6			2	4	16
	Chapter 3: Electromagnetic Wave Propagation 3.1. Introduction 3.2. Waves in general 3.3. Wave Propagation in Lossy Dielectrics 3.4. Plane Waves in Free Space 3.5. Plane Waves in Lossless Dielectrics 3.6. Plane Waves in Good Conductors 3.7. Power and Poynting Vector 3.8. Refection of Plane Wave at Normal and Oblique Incidence	2,4	8	12			2	8	30
	Chapter 4 EM waves in Transmission lines 4.1. Transmission line model 4.2. Transmission Line Equation 4.3. Input Impedance, SWR, and Power 4.4. The Smith Chart 4.5. Some Applications of Transmission Lines	2,3	8	12			1	8	29

	Chapter 5: Waveguides 5.1. Introduction 5.2. Rectangular Waveguides 5.3. TM Modes and TE Modes 5.4. Power Transmission and Attenuation 5.5. Waveguide Resonators	2,4	6	9			1.5	6	25.5
	Total		28	42			7.5	28	105.5

Assessment						
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	20	√		4
2	Quiz	5	√		.75
3	Assignments	10		√	2.5
4	Project	15	√	√	4.25
5	Choose an item.				
				Total	11.5
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	√		3
				Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Choose an item.
		2	Choose an item.
13	Textbook and reference:	1	Matthew N. O. Sadiku: Elements of Electromagnetics, Oxford University Press, USA; 7th Ed, 2018[Textbook]
		2	David H. Staelin: Electromagnetic Waves, Prentice Hall PTR, 1994

2.17.3.3 Telecommunication Networks

Addis Ababa Science and Technology University			
1	College: Electrical and Mechanical Engineering		Department: Electrical Engineering
2	Course Category	Core Course	Course Code: ECEg5311
	Course Name	Telecommunication Networks	
3	Synopsis:	This course describes History and Evolution of Telecommunication networks, Basics of Telecom Networks, Introduction to digital telecom signaling and applications, Public Switched Telephone Network (PSTN) and Public Land Mobile Networks, Introduction to Digital Subscriber Line Technologies, and Emerging telecom networks.	
4	Name(s) of Academic Staff:		
5	Semester and Year offered:	Semester: I	Year: 5
6	Credit Hour:	3	
7	Prerequisite/ Co-requisite:	Digital Communication Systems (4304)	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Identify basic features of current and future popular telecommunication networks	
	CLO2	Understand the importance of local and global standardization in telecommunication technologies and services	
	CLO3	Analyze digital signaling techniques	
	CLO4	Design and analyze sensor and ad-hoc networks	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods: L	T	P	O	Assessment: Test	Quiz	Assignment	Project	Lab-report
CLO1		√											√				√	√	√		
CLO2			√										√	√			√		√		
CLO3			√										√	√		√				√	
CLO4				√									√	√		√				√	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F) L	T	P	O	Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT)

	Chapter 1: Introduction to Telecommunication Systems 1.1 Introduction 1.2 Historical Perspective 1.3 Standard Organizations 1.4 Telecommunication Services	1,2	2hrs					4hrs	6hrs
	Chapter 2: Digital Telecommunication Transmission Principles 2.1 Introduction 2.2 Digital Representation of Information, 2.3 Digital Processing of Analog Signals 2.4 Line Coding 2.5 Digital Modulation Techniques, 2.6 Digital Hierarchy Technologies	1,2,3	6hrs	6hrs			2hrs	8hrs	22hrs
	Chapter 3: Public Switched Telephone Networks (PSTN) 3.1 Overview of PSTN 3.2 Basic Elements of the PSTN 3.3 Switching and Signaling 3.4 Techniques for the PSTN	1,2	6hrs	6hrs			2hrs	5hrs	19hrs
	Chapter 4: Introduction to Digital Subscriber Line (DSL) Technologies 4.1 Introduction 4.2 Types of DSL Technology 4.3 Comparison of DSL and Cable Modem Technologies	1,2,3	6hrs	9hrs		2hrs		8hrs	25hrs
	Chapter 5: Overview of Packet Switched and Circuit Switched Networks 5.1 Introduction 5.2 Switching Techniques 5.3 Packet Switched Networks 5.4 Circuit Switched Networks	2,3	4hrs	6hrs		2hrs		5hrs	17hrs
	Chapter 6: Emerging Telecommunication Networks 6.1 Introduction 6.2 Wireless Sensor Networks 6.3 Mobile Adhoc Networks, 6.4 Intelligent Networks	2,3,4	4hrs	6hrs		2hrs		4hrs	16hrs
	Total		28hrs	33hrs		6hrs	4hrs	34hrs	105

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quize	5%	√		1hr
2	Assignments	10%		√	3hrs
3	Tests	20%	√		4hrs
4	Project	15%	√	√	4hrs
5	Choose an item.				

						Total	12hrs
	Final Exam			Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam			50%	√		3hrs
						Grand Total SLT	120hrs
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.						
12	Special requirements and resources to deliver the course	1	Simulation Room				
		2	Software				
		3	Industry Visit: Telecom industries				
13	Textbook and reference:	1	T. Anttalainen, Introduction to Telecommunications Network Engineering", 2nd Ed., 2003.				
		2	T. Saadawi, Fundamentals of Telecommunication Networks"				
		3	John Wiley and Sons, 1994.				

2.17.3.4 Microwave Devices and Systems

Addis Ababa Science and Technology University			
1	College: Electrical and Mechanical Engineering		Department: Electrical Engineering
2	Module Category	Core Course	Course Code: ECEg5301
	Course Name	Microwave Devices and Systems	
3	Synopsis:	The course mainly deals with different types of waveguides, mostly passive and partly active microwave devices and systems and their application in communication systems. The course focuses on concepts, theories and applications of microwave devices and systems. The course also comprises of a term paper. It consists of: Principles and Analysis of Waveguides, Introduction to Microwave Circuits, Review of Network Parameters and Transmission Line Theory, The Scattering Parameters, Impedance Matching, Passive Microwave Components and Networks, Introduction to Active Microwave Devices.	
4	Name(s) of Academic Staff:		
5	Semester and Year offered:	Semester: I	Year: 5
6	Credit Hour:	3	
7	Prerequisite/ Co-requisite:	EM Waves and Guide Structure (ECEg4308)	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		

CLO1	Explain the fundamentals of Microwave Techniques.
CLO2	Analyze transmission Line theory and Planar Transmission Lines.
CLO3	Provide theoretical analysis of transmission lines and microwave circuits, hands-on training on engineering tools such as Smith Chart, EDA software and RF instruments.
CLO4	Identify passive and active microwave devices.
CLO5	Obtain engineering design experience through team-based design projects.

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√	√			√		√		
CLO2		√											√	√	√		√		√		√
CLO3						√							√	√	√		√	√	√		√
CLO4			√										√	√	√		√	√	√		√
CLO5				√									√		√					√	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1	
2	
3…etc.	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			

	Chapter 1:Fundamentals of Microwave Techniques 1.1 Introduction 1.2 Why Microwave 1.3 Application of Microwaves	CLO1	4hrs	6hrs				4hrs	14hrs
	Chapter 2:Review of Transmission Line and Waveguide Theory 2.1 Review of Classification of Wave solutions. 2.2 Travelling Waves and Transmission Line Concepts 2.3 Different Types of Transmission Lines 2.4 Different Types of Waveguides	CLO2	4hrs	6hrs	2rs			4hrs	16 hrs
	Chapter 3:Analysis of Microwave Networks and Circuits 3.1 Two-port networks 3.2 The Impedance, Admittance, Hybrid and ABCD Matrices 3.3 The Scattering Parameters	CLO3	6hrs	4hr	6hrs		2hrs	6hrs	24hrs
	Chapter 4:Impedance Matching a. The Smith Charts and Matching b. Matching with Lumped Elements (L Networks) c. Single-stub Matching d. Double-stub Matching Quarter-wave Transformer.	CLO4	8hrs	4hr	12hrs		2hrs	4hrs	30hrs
	Chapter 5:Introduction to passive and Active Microwave Devices and Networks 5.1 Microwave Resonators, Power Dividers and Directional Couplers, Microwave Filters 5.2 2Microwave Diodes, Microwave Transistors and Amplifiers, Microwave Tube 5.3 Term Paper	CLO5	6hrs		8hrs		2hrs	6hrs	22hrs
	Total		28hrs	20hrs	28hrs		6hrs	24 hrs	106hrs

	Assessment					
	Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
	1	Assignments	15%	√		1.5hrs
	2	Tests	15%	√		1hr
	3	Quize	5%	√		0.5hr
	4	Project	15%		√	8 hrs
	5	Others				
					Total	11 hrs
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50%	√		3hrs

			Grand Total SLT | 120
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.		
12	Special requirements and resources to deliver the course	1	Computer Lab
		2	Simulation Room
		3	Workshop
		4	Industry Visit : Microwave backbone Networks, Telecom towers
13	Textbook and reference:	1	Gonzalez, Microwave Transistor, amplifier analysis and design, 2nd Ed, Pearson, 1996.
		2	David M. Pozar, Microwave Engineering, 4th Ed, Wiley, 2011.
		3	R.E. Collin, Foundations of Microwave Engineering, 2nd Ed, Wiley-IEEE Press, 2001.

2.17.3.5 Fiber Optics Communications

Addis Ababa Science and Technology University					
1	College: Electrical and Mechanical Engineering		Department: Electrical Engineering		
2	Course Category	Core Module	Course Code: ECEg5303		
	Course Name	Fiber Optics Communications			
3	Synopsis:	This is an introductory course on optics and optical communications using fibers. The course provides an overview of the principles underlying the nature of light wave, its propagation through different media and methods of analysis of optical transmission. It also introduces functional concepts and application of optical source, optical fiber and optical detector in communication systems.			
4	Name(s) of Academic Staff:				
5	Semester and Year offered:	Semester:	I	Year:	5
6	Credit Hour:	3			
7	Prerequisite/ Co-requisite:	Digital Communication Systems (ECEg4304)			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Distinguish fundamental concepts of light wave system generations, optical fibers and dispersion.			
	CLO2	Analyze light wave system.			
	CLO3	Design optical transmitter and receivers.			
	CLO4	Differentiate WDM techniques and optical amplifiers.			
	CLO5	Evaluate dispersion compensation techniques and realize their limitation.			

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
													Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√		√		√		√		√
CLO2		√											√				√	√			
CLO3			√										√		√		√			√	√
CLO4		√											√		√				√		√
CLO5		√											√						√		

Indicate the relevancy between the CLO and PO by ticking "√" on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1	Optical Designing
2	Demonstrating optical Simulations
3	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Introduction to optical communication systems	1,2	7		9		1	8	25

	1.1 Historical overview and current importance 1.2 Light wave system generations 1.3 System components 1.4 Optical fibers and modes 1.5 Dispersion in SM fibers and its limitations 1.6 Fiber loss and non-linear effects								
	Chapter 2: Optical Transmitters and Receivers Basic concepts 2.1 Transmitter design and optical sources 2.2 Receiver design and optical detectors 2.3 Optical amplifiers 2.4 Noise sensitivity and degradation	1,2,3	6		6		2	6	20
	Chapter 3: Lightwave Systems 3.1 Principles of coherent detection 3.2 Bit error rate performance 3.3 WDM Lightwave Systems 3.4 Types of WDM 3.5 Wavelength converting transponders 3.6 Capacity of WDM system	2,4	5		6		1	7	19
	Chapter 4: Light Signal Amplifiers Circuits 4.1 Gain spectrum and bandwidth 4.2 Gain saturation 4.3 Amplifier applications 4.4 Types of optical amplifiers 4.5 Semiconductor optical amplifiers	4	5		6		1	5	17
	Chapter 5: Light Signal Dispersion Compensation 5.1 Basic propagation equation 5.2 Need for dispersion management 5.3 Pre-compensation schemes 5.4 Post-compensation techniques 5.5 Dispersion-compensating fibers	5	5		9		1	5	20
	Total		28		36		6	31	101

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	20	√		3
2	Assignments	10		√	3
3	Quiz	5	√		1
4	Project	10	√	√	2
5	Lab-report	5		√	1

					Total	10
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50	3		3
					Grand Total SLT	114
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					
12	Special requirements and resources to deliver the course	1	Simulation Room			
		2	Software			
		3	Industries Visit: Ethio-telecom college laboratories			
13	Textbook and reference:	1	Agarwal G.P., "Fiber optic communication systems", 4th Ed., John Wiley and Sons, New York, 2010.			
		2	G.Keiser, "Optical fiber communication systems", 5th Ed., McGraw-Hill, New York, 2014.			
		3	John M. Senior "Optical fiber communications: principle and practice" 3rd Ed., Prentice Hall, 2009.			

2.17.3.6 Antennas and Radio Wave Propagations

Addis Ababa Science and Technology University			
1	College: Electrical and Mechanical Engineering		Department: Electrical Engineering
2	Course Category	Focus area course	Course Code: ECEg-5305
3	Synopsis:	In this course we discuss about: basic electromagnetic wave equations ,far field equation Antenna terminologies and parameters, linear type of antenna, array antenna types and working principle, wave propagation method : ground wave, sky wave propagation , basics of Radar communication .	
4	Name(s) of Academic Staff:		
5	Semester and Year offered:	Semester: I	Year: 5
6	Credit Hour:	4	
7	Prerequisite/ Co-requisite:	EM Waves and Guide Structures (ECEg4308)	

8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:
CLO1	To understand and quantify how antennas launch electromagnetic waves into the surrounding medium.
CLO2	Understand types of antennas and analyze their radiation characteristics.
CLO3	Analyze radio waves (Ground waves, Sky waves. Line of Sight waves, etc.) propagation methods and implementing for different applications
CLO4	Analyze antenna arraying
CLO5	Design small wire type of antennas using MATLAB and Ansoft HFSS simulators for different project applications.

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√				√								√	√	√		√				√
CLO2	√				√								√		√				√		√
CLO3		√	√										√	√			√	√	√		
CLO4				√									√		√		√			√	
CLO5				√										√				√			√

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)
1	Use Antenna Trainer , use of Lecher Line, signal detection and signal measurement for different type of antenna.
2	
3…etc.	

26 18 10	Distribution of Student Learning Time (SLT)					
	Course Content Outline	CLO	Teaching and Learning Activities			Total (SLT)
			Guided learning (F2F)	Guided Learning (NF2F)	Independent Learning (NF2F)	

			L (hr)	T (hr)	P (hr)	O	(hr)	(hr)	(hr)
	Chapter 1: Basics of Antenna 1.1, Basics Principles of antenna 1.2. Types of antenna 1.3. Electromagnetic Wave radiation Mechanisms 1.4. Radiation Integrals and auxiliary Potential Functions. 1.5. Field zones	CLO2 CLO1	4	2	2				8
	Chapter 2: Antenna Terminologies and Antenna parameters 2.1. Radiation Pattern 2.2. Radiation power density and radiation intensity 2.3. Antenna Aperture and effective aperture 2,4, Reciprocity theorem and Isotropic radiator 2.5. Directivity, Gain and Beam width 2.6, Antenna Equivalent Circuit and maximum power transfer	CLO1	4	2	6			4	16
	Chapter 3:Types of Antenna and their characteristics 3.1. Introduction 3.2. Wire types 3.2.1. Hertizian dipole 3.2 standing wave antenna 3.2.3. half wave and monopole antennas 3.2.4. travelling wave and loop antenna 3.3. Aperture Antenna 3.3.1. Horn antenna 3.3.2. Parabolic reflector antenna	ClO2 CLO5	6	4	8		4	4	
	Chapter 4: Microstrip Antenna 4.1. Introduction 4.2 Advantages and limitations of MSA 4.3 Rectangular Patch antennas Geometry and parameters 4.4. characteristics of Micro strip antennas, Impact of different parameters	CLO1 and ClO2	4	2	4		4	4	18
	Chapter 5:Antenna Arrays 5.1. Introduction 5.2.Two Element array 5.3.N-Element linear Array 5.4. Broadside array	CLO1 and CLO4	4	2	4				10
	Chapter 6: Radio Wave propagation 6.1. introduction to radio wave propagation	CLO3	6	2	4		4	4	20
	6.2. Ground wave propagations								

	6.3. Space wave propagations 6.4. Line of Sight propagation 6.5. Ionosphere Propagation and noise 6.6 .Basics of Radar communication								
	Total		**28**	**14**	**28**		**12**	**16**	**98hr**

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT (hr)
1	Tests	10%	1.5		1.5
2	Assignments	15%		3	3
3	Tests	10%	1.5		1.5
4	Quize	5%	1		1
5	Lab-report	10%	4	8	12
				Total	**19**
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT (hr)
Final Exam			3		**3**
				Grand Total SLT	**120 hr**

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software
		2	Simulation Room
		3	Computer Lab
13	Textbook and reference:	1	John D. Kraus and Ronald J. Marhefka, "Antennas and wave propagations", The McGraw Hill company, 5th Ed, 2017.
		2	Orfanidis J.S, “Electromagnetic waves and antennas”, Rutgers University, 2016.

2.17.3.7 Wireless and Mobile Communications

Addis Ababa Science and Technology University						
1	College: Electrical and Mechanical Engineering		Department: Electrical and Computer Engineering			
2	Course Category	Focus area course	Course Code: ECEg5307			
3	Synopsis:	Basics of wireless communication system, evolution of wireless networks, standards, wireless communication challenges, wireless propagation channels , modern wireless mobile communication networks , wireless channel capacity, multiple access systems , wireless resource managements , diversity techniques and mitigation methods of signal fading .				
4	Name(s) of Academic Staff:					
5	Semester and Year offered:	Semester:	I	Year:	V	
6	Credit Hour:	4				
7	Prerequisite/ Co-requisite:	Digital Communication Systems (ECEg4304)				

8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Understanding the general principles of wireless and mobile communication
	CLO2	Understanding the fundamental problems and counter-measure techniques wireless mobile networks
	CLO3	Design mitigation techniques to minimize wireless channels problems
	CLO4	Analyzing the basic principles of radio resource management in wireless communications
	CLO5	Understanding and analyzing different mobile communication networks and also apply them for different applications .

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√				√				
CLO2					√								√	√	√			√			√
CLO3			√	√									√	√					√		
CLO4			√	√									√	√	√		√				√
CLO5													√		√				√		√

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	

1 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L (hr)	T (hr)	P (hr)	O		(hr)	

	Chapter 1: Overview of Wireless and Mobile Communications **1.1** Basic concept of wireless/ Radio communication **1.2.** Evolution of Mobile radio Communications networks and their standards **1.3**. Some Common wireless mobile radio Systems 1.4.Capacity of Wireless Channels and Shannon spectral efficiency	CLO1	6					4	10
	Chapter 2: Mobile Radio propagation channel 2.1.Introduction 2.2. Large scale propagation channel model. 2.2.1.Free space propagation model 2.2.2. Two-Ray model 2.3. Small scale propagation channel model 2.3.1. Multipath fading 2.3.2. Flat fading 2.3.3.Frequency selective fading	CLO2	9	4	6			12	31
	Chapter 3: Cellular Concepts 3.1. Introduction 3.2. Frequency reuse 3.3. Channel assignment strategies 3.4. Trunking and grade of services 3.5. Co-channel interference and system Capacity 3.6. Handoff strategies	CLO3	9	4	6		4	9	32
	Chapter 4: Mitigation Techniques 4.1. Equalization Techniques 4.2. Diversity Techniques 4.3. Channel Coding	CLO4	6	3	4			6	19
	Chapter 5: Multiple Access Techniques 5.1. Frequency Division Multiple Access (FDMA) 5.2. Time Division Multiple Access (TDMA) 5.3. Frequency Hopping and Code Division Multiple Access 5.4. Orthogonal Frequency Division Multiple Access (OFDMA)	CLO3 and CLO4	4		4			6	14

	Chapter 6: Modern Wireless mobile Networks 6.1. Global System for Mobile Communications (GSM) 6.2. General Packet Radio Service (GPRS) 6.3. Introduction to Universal Mobile Telecommunications System (UMTS). 6.4. Fifth Generation (5G) Systems, Basics of Long Term Evolution (LTE)	CLO5	8	3	8		4	6	29
	Total		**42**	**14**	**28**				**135hr**

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F (Hr)	NF2F (Hr)	SLT (Hr)
1	Quizzes	5	1		1
2	Assignments	15		9	9
3	Lab-report	10		9	9
4	Test1	10	1.5		1.5
5	Test2	10	1.5		1.5
				Total	**22**

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	3		**3**
			Grand Total SLT	**160 hr**

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software
		2	Simulation Room
		3	Computer Lab
13	Textbook and reference:	1	Theodore S. Rappaport, "Wireless Communications: Principle and Practice", Prentice Hall PTR, 2nd Ed, 2002.
		2	A. Goldsmith, "Wireless Communications", 2nd Ed, Wiley-IEEE Press, 2012.
		3	P. M. Shankar, "Introduction to Wireless Systems", Drexel Univ., 2001.
		4	Jochen H. Schiller "Mobile Communications", 2nd Ed, Pearson India, 2012.

2.17.3.8 Switching and Intelligent networks

Addis Ababa Science and Technology University					
1	College: Electrical and Mechanical Engineering		Department: Electrical Engineering		
2	Course Category	Core Module	Course Code: ECEg5302		
	Course Name	Switching and Intelligent Networks			
3	Synopsis:	This course aims at introducing the knowledge about the telecommunication switching: its design and principles, and also the theoretical basis about performance and operation (multiplexing, switching, routing, and signaling) in telecom networks.			
4	Name(s) of Academic Staff:				
5	Semester and Year offered:	Semester:	II	Year:	5
6	Credit Hour:	3			
7	Prerequisite/ Co-requisite:	Telecommunication Networks (5311)			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Differentiate types of Switching systems and their working principles.			
	CLO2	Compare various digital switching techniques and point out advances in switching.			
	CLO3	Analyze the concept of modern switching used in Integrated Service Digital Network.			
	CLO4	Generalize the applications of Intelligent Network systems.			
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:				

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√		√		√		√		√
CLO2					√								√				√	√			
CLO3		√											√		√		√			√	√
CLO4			√										√						√		

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)
1	Switch Designing
2	Demonstrating Switching Simulations

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F) L	T	P	O	Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT)
Chapter 1: Introduction to Switching Systems 1.1 Introduction to Switching Function 1.2 Elements of Switching 1.3 Basic Principle of Switching 1.4 Circuit Switching and Packet Switching	1,2,3	7	3	9		2	8	29

	1.5 Design parameters of Telecom switch								
	Chapter 2: Switching Techniques 2.1 Space Division switching 2.2 Multiple stage switching 2.3 Blocking probabilities 2.4 Folded four wire switches 2.5 Time Division Switching 2.6 Analog Time division switching 2.7 Digital Time Division switching 2.8 Two-dimensional Switching 2.9 STS switching 2.10 TST switching and STN switching	1,2,3	10	3	6		2	6	27
	Chapter 3: Advances in Switching and an Overview of ISDN 3.1 Introduction to advances in switching Shared-Memory Fast Packet switches 3.2 Shared-Medium Switches 3.3 Fast-Packet Switches 3.4 Space-Division Fast Packet Switches 3.5 ISDN	1,2	5	3	6		2	7	23
	Chapter 4: Intelligent Networks 4.1 Introduction to Intelligent Network 4.2 Driving Forces behind the IN 4.3 Overview of IN 4.4 IN Architecture 4.5 Call Control 4.6 Various Service functions (Creation, Service control, Service Management)	1,2,4	6	3	3		2	5	19
	Total		28	12	24		8	26	98

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	20	3		3
2	Assignments	10		3	3
3	Quiz	5	1		1
4	Project	10	1	1	2
5	Lab-report	5		1	1
				Total	10

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	3		3
			Grand Total SLT	111

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements	1	Simulation Room

	and resources to deliver the course	2	Software
		3	Laboratories
		4	Industry Visit: Telecom soft switches
13	Textbook and reference:	1	T. Vishwanathan and M. Bhatnagar "Telecommunication Switching Systems and Networks", 2^{nd} Ed, PHI,2015
		2	P. Gnanasivam 'Telecommunication Switching and Network' 2 Ed., New Age International, 2005.

2.17.4 Computer Engineering Focus Area Courses

2.17.4.1 Data Structure and Algorithms

Addis Ababa Science and Technology University							
1	College: Electrical and mechanical			Department: Electrical and computer engineering			
	Course Name	Data Structures and Algorithms					
	Course Code:	ECEg4404					
3	Synopsis:	1. Understanding of fundamental Data Structures including linked-lists, trees, binary search trees, AVL trees, stacks, queues, priority queues. 2. Understanding of fundamental abstract data types which can include: Maps, Sets and Vectors. 3. Ability to devise novel solutions to small scale programming challenges involving data structures and recursion. 4. Ability to estimate the algorithmic complexity of simple, non-recursive programs 5. Ability to sensibly select appropriate data structures and algorithms for problems and to justify that choice.					
4	Name(s) of Academic Staff:	Solomon Zemene					
5	Semester and Year offered:	Semester:	II	Year:	4		
6	Credit Hour:	4					
7	Prerequisite/ Co-requisite:	C++ Programming (ECEg2108)					
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:						
	CLO1	Describe different kinds of data structures such as stack, queue, linked list, tree and graph as well as sorting and other algorithms.					
	CLO2	Apply experimentally data structures to different sorting and other algorithms.					
	CLO3	Analyze any kinds of algorithms using the concept of big o notation.					
	CLO4	Compare the efficiency of different algorithms based on their running time.					
	CLO5	Design algorithms to solve different real problems that need software solutions.					
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:						

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)													Asses			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods	Test		Quiz	Assignment
													L	T	P	O	
CLO1						√							√				15
CLO2						√							√		√		15

	CLO3					√									√	√		15
	CLO4			√											√	√		10
	CLO5					√									√	√		10
	Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box																	

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Algorithm Analysis 1.1 Introduction – Mathematical Functions	CLO3 CLO4	4	6	6			2	18
1.2 General Big-Oh Rules	CLO3, CLO4							
Chapter 2: ADT 2.1 Linked Lists	CLO1 CLO2 CLO5	4	6	6			2	18
2.2 Stacks Queues	CLO1 CLO2 CLO5							
Chapter 3: Trees 3.1 General Trees – Introduction Binary Trees	CLO1 CLO2 CLO5	6	9	9			2	26
3.2 Binary Search Trees AVL Trees	CLO1 CLO2 CLO5							
3.3 Heap	CLO1 CLO2 CLO5							
Chapter 4: Sorting 4.1 Insertion Sort Heap Sort	CLO1 CLO2 CLO5	4	6	6			2	18
4.2 Merge Sort Quick Sort	CLO1 CLO2 CLO5							
Chapter 5: Graph 5.1 Representation of Graphs Topological Sort	CLO1 CLO2 CLO5	6	9	9			2	26
5.2 Shortest-Path Algorithms	CLO1 CLO2 CLO5							
5.3 Minimum Spanning Tree Depth-First Search	CLO1 CLO2 CLO5							

	Chapter 6: Algorithm Design Techniques 6.1 Greedy algorithms	CLO1 CLO2 CLO5	4	6	6			2	18
	6.2 Divide and Conquer	CLO1 CLO2 CLO5							
	Chapter 7: Introduction to Parallel Computation 7.1 Introduction	CLO3 CLO4 CLO5							
	Total								140

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	5	1	1	2
2	Test	10	1	1	2
3	Assignment	10		2	2
4	Project	20		4	4
5	Lab report	5		2	2
				Total	12
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	3	5	8
				Grand Total SLT	160

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room)	1	Software (C or JAVA)
		2	Computer lab
13	Textbook and reference:	1	Weiss, Mark (2013), 4th edition, Data Structures and Algorithms Analysis in C++. Benjamin Cummings Publishing, ISBN-10 : 013284737X ISBN-13 : 978-0132847377
		2	Sahni, Sartaj (2005), 2nd edition, Data Structures, Algorithms and Applications in C++. McGraw-Hill, ISBN: 0-929306-32-5
		3	Horowitz, Ellis; Sartaj Sahni; and Dinesh Mehta (2008), 2nd edition, Fundamentals of Data Structures in C++. Computer Science Press, ISBN-10 : 8173716064, ISBN-13 : 978-8173716065
		4	Sengupta, S. and C. Korobkin (2014) C++ Object-Oriented Data Structures. Springer, Softcover reprint of the original 1st ed. 1994 edition (February 15, 2014), ISBN-10 : 1461276187, ISBN-13 : 978-1461276180

2.17.4.2 New Trends in Computer Engineering

	Addis Ababa Science and Technology University		
1	College: Electrical and mechanical		Department: Electrical and computer engineering
	Curse Name	New Trends in Computer Engineering	
	Course Code:	ECEg5402	
3	Synopsis:	This course gives the program an opportunity to select topics that are new and emerging for students to learn which are not dealt in other courses. This is one reflection of the dynamic nature of the computing field of study. Specific topics to be covered will be selected by the responsible instructors upon the approval of the department council.	
4	Name(s) of Academic Staff:	Dr. Asrat Mulatu asrat.mulatu@aastu.edu.et	
5	Semester and Year offered:	Semester: II	Year: 5
6	Credit Hour:	2	
7	Prerequisite/ Co-requisite:	4^{th} year standing	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Describe most of the current and emerging technologies and systems in computing.	
	CLO2	Choose the most appropriate computing system and technology for solving specific computing problems.	
	CLO3	Experiment with emerging computing technologies and systems in the pursuit of innovative and techno-preneural solutions.	
	CLO4	Judge the usefulness of emerging systems, technologies, services and platforms from personal, societal and national perspectives.	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1		√											√				10		5		
CLO2					√								√		√		15	5	5		
CLO3			√										√		√					30	
CLO4						√							√				15	5	10		
Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box																					

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Introduction 1.1 What is computing?	CLO1	1						1

	1.2 What is CE	CLO1	1						1
	1.3CE technical spectrum	CLO1	1						1
	Chapter 2: Emerging Trends in Networking and Communications 2.1 IoT and IoE	CLO2 CLO3 CLO4	1		3			1	5
	2.2 5G	CLO2 CLO3 CLO4	1		3			1	5
	2.12 SDNs	CLO2 CLO3 CLO4	1		3			1	5
	2.4 Network Function Virtualization (NFV)	CLO2 CLO3 CLO4	1		3			1	5
	2.5 Wireless and Mobile Systems	CLO2 CLO3 CLO4	1		3			1	4
	Chapter 3: Cyber Physical Systems (CPS) 3.1 Introduction	CLO2 CLO3 CLO4	1		3			1	4
	Chapter 4: AI and Robotics 4.1 Self-driving cars	CLO2 CLO3 CLO4	2		3			1	6
	4.2 Machine Learning, Data Science and Analytics	CLO2 CLO3 CLO4	2		3			1	6
	4.3 High Performance Computing	CLO2 CLO3 CLO4	2		3			1	6
	Chapter 5: Various Trends in Computing 5.1 Storage Technologies	CLO2 CLO3 CLO4	1		3			1	5
	5.2 Virtual Reality and Augmented Reality	CLO2 CLO3 CLO4	2		3				5
	5.3 Software Systems and Technologies	CLO2 CLO3 CLO4	1		3				4
	5.4 Security and Privacy	CLO2 CLO3 CLO4	2		3				5
	5.5 Distributed and Cloud computing	CLO2 CLO3 CLO4	2		3				5
	Total								75

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Assignment	20	1		1
2	Project	30	2		2
3	Application and usefulness	10	2		2
4	Choose an item.				
5	Choose an item.				
				Total	5
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT

	Final Exam		40			
					Grand Total SLT	80
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					
12	Special requirements and resources to deliver the course	1	Software			
		2	Industry Visit			
13	Textbook and reference:	1	None			

2.17.4.3 Operating Systems

Addis Ababa Science and Technology University		
1	College: Electrical and mechanical	Department: Electrical and computer engineering
	Course Name	Operating Systems
	Course Code:	ECEg5401
3	Synopsis:	This course deals with the fundamental theories and principles that lay the ground for the functionality of traditional and modern operating systems. It examines basic issues in operating system design and implementation. It also covers the tradeoffs that can be made between performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to the major subsystems: process management, memory management, file and I/O. Moreover, the course will have a series of laboratory sessions based on the Linux kernel. The sessions involve, among other things, implementing and testing of operating system concepts using the C programming language.
4	Name(s) of Academic Staff:	Dr. Asrat Mulatu **asrat.mulatu@aastu.edu.et**
5	Semester and Year offered:	Semester: I; Year: 5th
6	Credit Hour:	3
7	Prerequisite/ Co-requisite:	Computer Organization and Architecture (ECEg4103) and Data structure and Algorithm Design (ECEg4404)
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Relate how operating systems as system software are vital in computing systems.
	CLO2	Demonstrate a deep understanding of how operating systems work internally.
	CLO3	Experiment with the various tools and algorithms used in both popular and emerging operating systems.
	CLO4	Make use of existing operating systems to solve common computing problems based on ethics and professionalism.
	CLO5	Identify emerging operating systems trends and utilize professional platforms to keep abreast with new developments.
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1				√									√				5				
CLO2	√												√				5	5			
CLO3					√								√		√		10		5	10	
CLO4						√							√		√		10		5	10	
CLO5												√	√		√		10		5	10	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	
11	Distribution of Student Learning Time (SLT)	
		Teaching and Learning Activities — Total

	Course Content Outline	CLO	Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	(SLT)
			L	T	P	O			
	Chapter 1: Introduction 1.1 Basics of operating systems	CLO1	1						2
	1.2 History of operating system	CLO1	1						2
	1.3 Types of operating systems	CLO1	1						2
	1.4 Functions of operating systems	CLO1	1						2
	1.5 Components of operating systems	CLO1	1						2
	1.6 Structures of operating systems	CLO1	1						2
	Chapter 2: Process management 2.1 Introduction to process	CLO2 CLO3 CLO4	1		3				6
	2.2 Introduction to threads	CLO2 CLO3 CLO4	2		3				7
	2.3 Inter-process communication	CLO2 CLO3 CLO4	2		3				7
	2.4 Classical IPC problems	CLO2 CLO3 CLO4	1		3				6
	2.5 Process scheduling	CLO2 CLO3 CLO4	2		3				7
	2.6 Deadlock	CLO2 CLO3 CLO4	2		3				7
	Chapter 3: Memory management 3.1 Basics of memory management	CLO2 CLO3 CLO4	1		3				6
	3.2 Swapping	CLO2 CLO3 CLO4	1		3				6
	3.3 Virtual memory	CLO2 CLO3 CLO4	2		3				7
	3.4 Page replacement algorithmes	CLO2 CLO3 CLO4	1		3				6
	3.5 Segmentation	CLO2 CLO3 CLO4	2		3				7
	Chapter 4: Files systems 4.1 Files and directories	CLO4 CLO5	5		9				14
	4.2 File system implementations	CLO4 CLO5							
	Chapter 5: Input and output 5.1 Principles of I/O hardware	CLO4 CLO5							
	5.2 Principles of I/O software	CLO4 CLO5							

	5.3 I/O software layers	CLO4 CLO5								
	Total									98
	Assessment									
	Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT				
	1	Test	10	1	1	2				
	2	Quiz	5	1	1	2				
	3	Project	30		6	6				
	4	Assignment	15		3	3				
					Total	13				
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT				
	Final Exam		40	3	6	9				
					Grand Total SLT	120				
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.									

12	Special requirements and resources to deliver the course	1	Software
		2	Computer lab
13	Textbook and reference:	1	Abraham Silberschatz, Operating System Concepts 10e, Wiley (WileyPLUS Products); 10 edition (May 2, 2018), ISBN-10: 1119456339, ISBN-13: 978-1119456339
		2	William Stallings, Operating Systems Internals and Design Principles,8th ed, Pearson; 8 edition (February 2, 2014), ISBN-10: 0133805913, ISBN-13: 978-0133805918
		3	K. C. Wang, Design and Implementation of the MTX Operating System, Springer; 1st ed. 2015 edition (July 16, 2015), ISBN-10: 3319175742 ISBN-13: 978-3319175744

2.17.4.4 Embedded Systems

Addis Ababa Science and Technology University						
1	College: Electrical and mechanical			Department: Electrical and computer		
	Course Name	Embedded Systems				
	Course Code:	ECEg5403				
3	Synopsis:	This course is designed to provide students a working knowledge of Embedded Systems their Design and Programming at an Introduction level. In this course the fundamentals of embedded systems, hardware and firmware designs will be explored. Issues such as embedded microcontrollers, embedded programs, real-time operating systems, low power computing, embedded systems implementations as well as optimization, internet of things, and some projects of embedded systems will be discussed.				
4	Name(s) of Academic Staff:	Yonas Tesfaye Yonas.tesfaye@aastu.edu.et				
5	Semester and Year offered:	Semester:	I	Year:	5	
6	Credit Hour:	4				
7	Prerequisite/ Co-requisite:	Microprocessors and Interfacing (ECEg4102)				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					

	CLO1	Explain Embedded systems and critically analyze the design metrics required for a product
	CLO2	Identify and justify different types of controller and peripheral options in the design of embedded system products.
	CLO3	Identify and Apply low power computing mechanism in the design of embedded system.
	CLO4	Identify and apply real time operating systems concept in the design of embedded systems.
	CLO5	Identify and apply internet of things concept in the design of embedded systems.
9	CLO6	Design and build an embedded system product based on the requirements given.

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
													Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√	√			√				
CLO2		√											√	√			√		√		
CLO3					√								√	√	√		√		√		
CLO4					√								√	√	√		√		√		
CLO5				√									√	√	√		√		√		
CLO6			√										√	√	√					√	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	
11	Distribution of Student Learning Time (SLT)	

	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	Chapter 1: Introduction 1.1 What is embedded system?	CLO1	1					2	3
	1.2 Characteristics, classification, advantages and disadvantages of ES Embedded systems architecture	CLO1	1					2	3
	1.3 Embedded systems design and development process	CLO1	1					2	3
	1.4 Embedded systems constraints, challenges and optimization of resources	CLO1	1					2	3
	Chapter 2: ES Implementation 2.1 Controller alternatives and criteria for choosing ➢ General purpose processors ➢ Application specific instruction set processors (ASIPs) (microcontrollers and DSP controllers) ➢ Programmable hardware (FPGAs) ➢ Application specific integrated circuits (ASIC)	CLO2 CLO6	1	1				2	4
	2.2 Peripheral alternatives ➢ Serial communications interfaces (RS232, RS485, I2C, SPI, UART, USB) ➢ Analog to digital and vice versa (ADC/DAC) ➢ Timers (PLL), Real time clock (RTC, Oscillators) capture/compare ➢ Debugging (JTAG, ISP, ICSP)	CLO2 CLO6	2	1				2	5
	2.3 Memory management	CLO2 CLO6	1					2	3
	Chapter 3: Low power computing 3.1 What motivates low power computing?	CLO3 CLO6	1					2	3
	3.2 Importance and challenges of low power computing	CLO3 CLO6	1				√	2	5
	3.3 The three approaches of low power computing ➢ Algorithm efficiency ➢ Dynamic power management ➢ Server virtualization	CLO3 CLO6	2	1			√	2	5

	3.4 Low power improvement options ➢ Transistor level improvements ➢ Single component level (RAM, CPU) ➢ System level	CLO3 CLO6	2	1			√	2	5
	3.5 Fundamentals of low power design ➢ System level ➢ Logic level ➢ Technological level	CLO3 CLO6	2	1			√	2	5
	Chapter 4: Real Time Operating Systems (RTOS) 4.1 Over view of operating system (Structure and components)	CLO4 CLO6	1				√	2	3
	4.2 What is an embedded operating system and why we need it?	CLO4 CLO6	1					2	3
	4.3 Similarities and differences of Embedded OS and General purpose OS	CLO4 CLO6	1					2	3
	4.4 Key characteristics and requirements of RTOS	CLO4 CLO6	1					2	3
	4.5 RTOS kernel ➢ Scheduler ➢ Objects ➢ Services	CLO4 CLO6	2	1				2	5
	4.6 Basic functions of RTOS ➢ Task management ➢ Interrupt handling ➢ Memory management ➢ Exception handling ➢ Task synchronization ➢ Task scheduling ➢ Time management	CLO4 CLO6	2	1				2	5
	4.7 Examples of RTOS ➢ RT Linux and its' architecture ➢ Linux Vs RT Linux ➢ Welknown RTOS	CLO4 CLO6	2	1				2	5
	Chapter 5: IoT 5.1 What is an IoT?	CLO5 CLO6	1					2	3
	5.2 Challenges, advantages and disadvantages of IoT	CLO5 CLO6	1					2	3
	5.3 Architecture of IoT	CLO5 CLO6	1					2	3
	5.4 IoT tools and platforms (LoRa, Zygbee)	CLO5 CLO6	2	1				2	5
	5.5 Application of IoT	CLO5 CLO6	1					2	3
	Chapter 6: ES projects 6.1 Elevator	CLO1 - CLO6			3			5	5

	6.2 Traffic Light control	CLO1 - CLO6			3			5	5
	6.3 Motor control (DC, brushless DC, stepper)	CLO1 - CLO6			3			5	5
	6.4 Smart home (remotely control home appliances like room lights, stove, refrigerator, and gate)	CLO1 - CLO6			3			5	5
	6.5 Smart farm (prototype for smart farm from seeding to harvesting)	CLO1 - CLO6			3			5	5
	Total								130

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test	30	2	2	4
2	Assignment	20		10	10
3	Project	50		10	10
4	Choose an item.				
5	Choose an item.				
				Total	14

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	0		6	6
			Grand Total SLT	160

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software's
		2	Project lab, Company Visit
13	Textbook and reference:	1	John B. Peatman, "Design with PIC Microcontrollers" Prentice Hall, 2003, ISBN-10 : 0130462136, ISBN-13 : 978-0130462138
		2	Rajkamal, 'Embedded System – Architecture, Programming, Design', Tata Mc Graw Hill, 2011.
		3	Muhammad Ali Mazidi, Rolin D. McKinlay, and Danny Causey, "The PIC Microcontroller and Embedded systems – Using Assembly and C for PIC18", Prentice Hall, 2007.
		4	Robert Faludi," Building wireless Sensor Networks", O'Reilly, 2011.
		5	Marco Schwartz,"Internet of things with ESP8266", PACKT publishing, 2016.
			Arnold S. Berger: Embedded Systems Design: An Introduction to Processes, Tools and Techniques 1st Edn, ISBN-10 : 1578200733 ISBN-13 : 978-1578200733

2.17.4.5 Data Communications and Computer Networks

Addis Ababa Science and Technology University					
1	College: Electrical and mechanical engineering		Department: Electrical and computer engineering		
	Module Name	Data communications and Computer Networks			
	Course Code:	ECEg4406			
3	Synopsis:	This course introduces the students to the concepts of the technology of data communications and networking, the course includes topic on communication models, network protocols, standards, LANs, WANs, the intranet, the internet and networking applications. The emphasis will be to develop an understanding of the underlying principles of data communications and networking.			
4	Name(s) of Academic Staff:	Netsanet Getnet Netsanet.getnet@aastu.edu.Et			
5	Semester and Year offered:	Semester:	II	Year:	4
6	Credit Hour:	4			
7	Prerequisite/ Co-requisite:	Introduction to Communication Systems (ECEg4101)			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Describe the hardware and software commonly used in data communications and computer network			
	CLO2	Explain and identify physical layer and medium			
	CLO3	Explain data link layer and its main task			
	CLO4	Explain network layer, router configuration, internet protocol			
	CLO5	Explain transport layer and major it's task			
1	CLO6	Identify various security threats, security mechanisms, and the security requirement of the network			
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:				

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	✓												✓				✓	✓	✓		
CLO2		✓											✓	✓			✓	✓	✓		
CLO3		✓											✓	✓			✓	✓	✓		
CLO4		✓											✓	✓			✓		✓		
CLO5		✓											✓	✓			✓		✓		
CLO6		✓											✓	✓			✓		✓		

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	
11	Distribution of Student Learning Time (SLT)	

		Teaching and Learning Activities	Total

	Course Content Outline	CLO	Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	(SLT)
			L	T	P	O			
	Chapter 1: Network fundamentals 1.1 Classification	CLO1	1					2	3
	1.2 Network taxonomy ➢ Packet switching ➢ Circuit switching	CLO1	1					2	3
	Chapter 2: Network performance 2.1 Bandwidth and propagation delay	CLO1	1					2	3
	2.2 Latency and throughput	CLO1	1					2	3
	Chapter 3: Network models 3.1 Internet model	CLO1	1					2	3
	3.2 OSI model	CLO1	2					2	4
	Chapter 4: Physical layer and medium 4.1 Data and signal transmission impairment	CLO2	1					2	3
	4.2 Digital Transmission – encoding	CLO2	1					2	3
	4.3 Analog Transmission – modulation and multiplexing	CLO2	1					3	4
	4.4 Using Telephone and Cable Networks for Data Transmission	CLO2	1					3	4
	Chapter 5: Data link layer 5.1 Error detection and correction	CLO3	2	1				3	6
	5.2 Control and protocols	CLO3	2					3	5
	5.3 Point-to-point and multiple access protocols	CLO3	1					3	4
	5.4 Local area networks, connecting LANs (bridges).	CLO3	2	1	3			3	9
	5.5 ATM networks	CLO3	2	1				3	6
	Chapter 6: Network layer 6.1 Internet protocol	CLO4 CLO6	2	1	3			3	9
	6.2 Host-to-host delivery –routing (unicast, multicast) and addressing	CLO4 CLO6	2	1	3			3	9
	6.3 Link state and distance vector routing	CLO4 CLO6	2	1				3	6
	6.4 Sub-netting	CLO4 CLO6	2	1	3			3	8
	Chapter 7: Transport layer 7.1 End-to-end protocols – UDP, TCP	CLO5 CLO6 CLO6	2	1				3	5
	7.2 TCP sliding window	CLO5 CLO6	2	1				3	5
	7.3 TCP adaptive timeout interval	CLO5 CLO6	2	1				3	6

	7.4 Congestion control and quality of service	CLO5 CLO6	2	1				3		6
	Total								120	

	Assessment					
	Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
	1	Test	30	2	6	8
	2	Assignment	20		9	9
					Total	
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50	3	20	23
					Grand Total SLT	
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					

12	Special requirements and resources to deliver the course	1	Software's
		2	Computer lab
		3	Company visit
13	Textbook and reference:	1	Larry Peterson, Bruce Davie, Computer Networks: A Systems Approach, 5th ed., (The Morgan Kaufmann Series) 2011, **ISBN-10/ASIN:** 0123850592 **ISBN-13:** 978-0123850591
		2	Behrouz Forouzan, Data Communications and Networking, 5th edition, Science Engineering and Math; 5th edition (July 1, 2012), ISBN-10 : 0073376221 ISBN-13 : 978-0073376226
		3	William Stallings, Data and Computer Communications, Pearson; 10th edition (September 13, 2013), ISBN-10 : 0133506487, ISBN-13 : 978-0133506488
		4	Larry Peterson, Bruce Davie, Computer Networks: A Systems Approach, 5th ed., (The Morgan Kaufmann Series) 2011, **ISBN-10/ASIN:** 0123850592 **ISBN-13:** 978-0123850591

2.17.4.6 Database Systems

Addis Ababa Science and Technology University			
1	College: Electrical and mechanical engineering	Department: Electrical and computer engineering	
	Course Name	Database Systems	
	Course Code:	ECEg4410	
3	Synopsis:	This course is designed to examine the principles and concepts of database systems and their application to real-world software systems. The topics covered include: Introduction to databases; Architecture of database systems; Database Models; The relational data model; The hierarchical data mode; Normalization; Principles and methodologies of database design, and techniques for database application development; Physical database design; logical database design; Database management systems; Overview of Structured Query Language (SQL).	
4	Name(s) of Academic Staff:	Netsanet Getnet Netsanet.getnet@aastu.edu.et	
5	Semester and Year offered:	Semester: II	Year: 4
6	Credit Hour:	3	
7	Prerequisite/ Co-requisite:	Object Oriented Programming (ECEg3109)	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Explain the basic concepts and the applications of database systems.	
	CLO2	Describe the basics of SQL and construct queries using SQL; Identify the relational database theory and apply write relational algebra expressions for queries; apply the E-R method and normalization approach for the logical design of database.	
	CLO3	Explain and identify basic database storage structures and access techniques: file and page organizations, indexing methods including B-tree, and hashing; Apply the basics of query evaluation techniques and query optimization.	
	CLO4	Differentiate the basic issues of transaction processing and concurrency control; Design and develop database application system in a group.	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	✓												✓				✓				
CLO2		✓											✓	✓	✓		✓		✓		
CLO3				✓									✓	✓	✓		✓		✓		
CLO4			✓										✓		✓		✓		✓	✓	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	
11	Distribution of Student Learning Time (SLT)	

	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	Chapter 1: Basic Concepts 1.1 Basic terminology, the notion of database systems	CLO1	1					2	3
	1.2 data independence and abstraction	CLO1	1					2	3
	1.3 the advantage of database systems	CLO1	1					2	3
	1.4 Data models and storages	CLO1	1					2	3
	1.5 Database system architecture	CLO1	1					2	3
	Chapter 2: The relational data model 2.1 Relational database systems and its three aspects	CLO2 CLO3	2	1				2	5
	2.2 Relational algebra	CLO2 CLO3	1					2	3
	Chapter 3: The SQL language 3.1 SQL language	CLO3	4	1	6			2	13
	Chapter 4: Database design 4.1ER modeling of database design	CLO2 CLO3 CLO4	2	1	3			2	8
	4.2 Functional dependency-based design of database	CLO2 CLO3 CLO4	2	1	3			2	8
	4.3 algorithms to perform decomposition (3NF, to BCNF)	CLO2 CLO3 CLO4	2	1				3	4
	Chapter 5: Storage and query processing 5.1 RAID	CLO2 CLO3	2					3	5
	5.2 Storage access	CLO2 CLO3 CLO4	2					3	5
	5.3 Indexing and hashing	CLO2 CLO3 CLO4	2	1	3			3	9
	5.4 Query processing and optimization	CLO2 CLO3 CLO4	2	1	3			3	9
	Chapter 6: Transaction Processing and Concurrency Control. 6.1 Transactions and ACID properties	CLO2 CLO3 CLO4	2	1				3	6
	6.2 Schedules	CLO2 CLO3 CLO4	1					3	4
	6.3 Serializability	CLO2 CLO3	1					3	4

		CLO4							
	6.4 Locking protocols: ➢ Two phase locking ➢ Dead lock and its protection	CLO2 CLO3 CLO4	2	1				3	6
	Total								104

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test	10	1	2	3
2	Assignment	20		3	3
3	Project	30		4	4
4	Choose an item.				
5	Choose an item.				
				Total	10
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		40	3	3	6
				Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Computer lab
13	Textbook and reference:	1	Avi Silberschatz , Henry F. Korth , and S. Sudarshan, "Database System Concepts", 6th *Edition*. McGraw-Hill. 2010, SBN-10 : 0073523321 ISBN-13 : 978-0073523323
		2	R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems", 7th ed. 2015, ISBN-10 : 0133970779, ISBN-13 : 978-0133970777
		3	J. A. Hofer, V. Ramesh and H. Topi, "Modern Database Management" 12th edition, 2015, ISBN-10 : 0133544613, ISBN-13 : 978-0133544619
		4	G. Molina and U. Widom, "Database Systems The Complete Book" 2008, **ISBN:**978-0-13-187325-4
		5	Avi Silberschatz , Henry F. Korth , and S. Sudarshan, "Database System Concepts", 6th *Edition*. McGraw-Hill. 2010, SBN-10 : 0073523321 ISBN-13 : 978-0073523323

2.17.4.7 Wireless Communication and Mobile Computing

Addis Ababa Science and Technology University						
1	College: Electrical and mechanical engineering			Department: Electrical and computer engineering		
	Course Name	Wireless Communications and Mobile Computing				
	Course Code:	ECEg5412				
3	Synopsis:	Network architectures: cellular networks, ad hoc networks; access protocols; radio and network resource management; quality of service; mobility and location management; routing; mobile-IP; current wireless technologies for personal, local and satellite networks.				
4	Name(s) of Academic Staff:	Dr. Dereje Yohannis				
5	Semester and Year offered:	Semester:	II	Year:	5	
6	Credit Hour:	3				
7	Prerequisite/ Co-requisite:	Data Communications and Computer Networking (ECEg4406)				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					

	CLO1	Explain the basics of communication systems
	CLO2	Explain and identify the wireless and mobile networks
	CLO3	Explain and identify Wifi and media access technologies
	CLO4	Explain and differentiate WSN and MANET
	CLO5	Explain and identify satellite and broadcast systems
1	CLO6	Explain and identify mobile communication and cellular network
1	CLO7	Describe and differentiate GSM, ULTS and LTE technologies
1	CLO8	Explain and identify mobile IP basics

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√				√				
CLO2		√											√		√		√		√		
CLO3		√											√		√		√		√		
CLO4		√											√		√		√		√		
CLO5		√											√				√		√		

CLO6		√											√		√		√		√		
CLO7		√											√		√		√		√		
CLO8		√											√				√		√		

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Introduction to communication systems 1.1 Definitions	CLO1	1					1	2
1.2 Main components of a communication system	CLO1	1					1	2
1.3 Main tasks of a communication system	CLO1	1					1	2
1.4 Communication system requirements	CLO1	1					1	2
1.5 Communication channels	CLO1	1					1	2
1.6 Physical and wireless transmission medias	CLO1	1					1	2
1.7Modulation and demodulation techniques	CLO1	1					1	2
1.8 Communication Errors and Prevention	CLO1	1					1	2
1.9Attenuation and Noise	CLO1	1					1	2
1.10 Communications Applications	CLO1	1					1	2
Chapter 2: Introduction to wireless and mobile networking 2.1 Wireless networks1	CLO2	1					1	2

	2.2 Wireless v/s Wired 1networks	CLO2	1					1	2
	2.3 Limitations of the mobile environment	CLO2	1					1	2
	2.4 Components of Wireless Communication ➢ Transmitters ➢ Antennas ➢ Signals ➢ Signal propagation ➢ Attenuation	CLO2	2		3				5
	2.5 Wireless Communication Technologies	CLO2	1					1	2
	Chapter 3: Wi-Fi (WLAN) and media access technologies 3.1 Introduction to WIfi	CLO3	1		3			1	5
	3.2 Basic architecture of Wifi	CLO3	1					1	2
	3.3 Advantages and disadvantages of Wifi	CLO3	1					1	2
	3.4 IEEE Wireless LAN Configurations	CLO3	1		2				3
	3.5 Infrastructure vs. Ad hoc networks	CLO3	1					1	2
	3.6 802.11 - MAC management	CLO3	1					1	2
	3.7 Media access control mechanisms ➢ Carrier Sense Multiple Access with Collision Detection (CSMA/CD) ➢ Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)	CLO3	2					1	3
	3.8 Summary of the 802.11x (Wi-Fi) Standards	CLO3	1		2			1	4
	Chapter 4: Introduction to wireless sensor networks (WSN) and MANET 4.1 Introduction	CLO4	1					1	2
	4.2 Comparison with ad hoc networks	CLO4	1					1	2
	4.3 Applications of Wireless Sensor networks	CLO4	1					1	2
	4.4 Characteristics of Wireless	CLO4	1					1	2

	Sensor Networks								
	4.5 WSN Design Challenges	CLO4	1		2			1	4
	4.6 Operational Challenges of WSN	CLO4	1		2			1	4
	4.7 WSN Enabling Technologies	CLO4	1		1			1	3
	4.8 Future of WSN	CLO4	1					1	2
	4.9 Introduction to MANET	CLO4	1					1	2
	4.10 Single and Multi-Hop MANET	CLO4	1					1	2
	4.11 MANET Applications	CLO4	1					1	2
	4.12 MANET Routing Protocols	CLO4	1					1	2
	Chapter 5: Satellite and broadcast systems 5.1 Introduction	CLO5	1					1	2
	5.2 Satellite System	CLO5	1					1	2
	5.3 Satellite system classes ➢ Geostationary Satellite systems ➢ LEO Systems ➢ MEO Systems ➢ Comparison of satellite-based systems	CLO5	2					1	3
	5.4 Global Positioning System, GPS ➢ Principles ➢ Source of errors	CLO5	1					1	2
	5.5 Broadcast Systems ➢ Digital Audio Broadcast, DAB ➢ Digital Video Broadcasting, DVB	CLO5	2					1	3
	Chapter 6: Mobile communication and cellular network 6.1 Principle of mobile communications	CLO6	1		2			1	4
	6.2 Cellular communication and system architecture	CLO6	1		2			1	4
	6.3 Mobile Cellular System Components	CLO6	1		2			1	4
	6.4 Cellular Network Organization	CLO6	1		2			1	4
	6.5 Concept of Handover and	CLO6	1		2			1	4

	location management								
	6.6 Interference and System Capacity	CLO6	1		1			1	3
	6.7 Improving call Coverage and Capacity	CLO6	1					1	2
	6.8 Cellular Systems Generations (1G, 2G, 3G ,4G and LTE)	CLO6	2					1	3
	Chapter 7: FSM, UMTS and LTE mobile technologies 7.1 Global system for mobile communication (GSM)	CLO7	1					1	2
	7.2 Performance characteristics of GSM	CLO7	1					1	2
	7.3 GSM Services	CLO7	1		1			1	3
	7.4 GSM Channels and Frequencies	CLO7	1		1			1	3
	7.5 GSM Architecture	CLO7	1		1			1	3
	7.6 Universal Mobile Telecommunications System (UMTS)	CLO7	1		2			1	4
	7.7 UMTS Architecture	CLO7	1					1	2
	7.8 4G Long Term Evolution (LTE)	CLO7	1					1	2
	7.9 Advantages of LTE	CLO7	1					1	2
	7.10 LTE Architecture	CLO7	1					1	2
	7.11 LTE vs UMTS	CLO7	1					1	2
	Chapter 8: Mobile IP basics 8.1 Introduction to Mobile IP	CLO8	1					1	2
	8.2 Mobile IP Entities	CLO8	1					1	2
	8.3 Mobile IP Support Services	CLO8	1					1	2
	8.4 Mobile IP Operation	CLO8	1					1	2
	8.5 Security in Mobile IP	CLO8	2					1	3
	8.6 Problems with Mobile IP	CLO8	1					1	2
	Total								160

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test	30			
2	Assignment	20			
				Total	

	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50			
					Grand Total SLT	160
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					
12	Special requirements and resources to deliver the course	1	Software, Company visit			
13	Textbook and reference:	1	Wireless Communications and Networks by Wiliam Stallings, Prentice Hall, 2005			
		2	Andreas F. Molisch, Wireless Communications, 2nd Edition, Willey printing press			
		3	David Tse and Pramod Viswanath, Fundamentals of *Wireless Communication* , Cambridge University Press			
		4	Dereje Yohannes, Fundamental Concepts on Wireless LAN and the IEEE 802.11 Protocol, Nuremberg (Germany) 2011 (ISBN 978-99944-995-7-1)			
		5	Jochen Schiller, Mobile Communications, 2nd edition, Addison Wesley, 2003. ISBN 0-321-12381-6			
		6	W. Stallings, Wireless Communications and Networks, Prentice-Hall, 2002 ISBN 0-13-040864-6			
		7	W. Stallings, Data and Computer Communications , 8th Edition, Prentice Hall, 2007, "ISBN-10" 0132433109 ("ISBN-13" 9780132433105)			
		8	A. Tanenbaum, Computer Networks, Prentice Hall, 1996, ISBN 0-13-349945-6. (4th edition released in 2003)			
		9	Alberto Leon-Garcia and Indra Widjaja, Communication networks, Fundamental concepts and key architectures, 2nd Edition,, Tata Mcgraw Hill Education Private limited, New Delhi 2011.			
		10	Balajikumar, Broadband Communications, Mc-Graw Hill, 2009.			
		11	Steve Wiseniewski, Network Administration, Pearson Education Asia, 2001			
		12	Useful resources from World Wide Web (WWW)			

2.17.4.8 Software Engineering

Addis Ababa Science and Technology University		
1	College: Electrical and mechanical engineering	Department: Electrical and computer engineering
	Course Name	Software Engineering
	Course Code:	ECEg4408
3	Synopsis:	This course introduces the major concepts and techniques of software engineering so that students can prepare for their future careers as software engineers. The course studies the software development process; software requirements and specifications; software design techniques; CASE tools and software development environments; software testing; documentation and maintenance. In general the course covers all aspects of software production ranging from the early stage of product concept to design and implementation to post-delivery maintenance.
4	Name(s) of Academic Staff:	Selam Damtewu solbdu@gmail.com
5	Semester and Year offered:	Semester: II Year: 4
6	Credit Hour:	3
7	Prerequisite/ Co-requisite:	Object Oriented Programming (ECEg3109)
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Explain general concepts and principles of software engineering
	CLO2	Identify and apply the software development life cycles and process models,
	CLO3	Justify how to manage software projects,
	CLO4	Design and develop softwares in a team,
	CLO5	Apply object-oriented analysis, design and implementation tehcniques,
	CLO6	Apply and use CASE tools for the development of software
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√	√			√				
CLO2					√								√	√			√			√	
CLO3							√						√	√			√				
CLO4									√				√	√						√	
CLO5								√					√	√						√	
CLO6					√								√	√						√	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	
11	Distribution of Student Learning Time (SLT)	

		Teaching and Learning Activities	Total

	Course Content Outline	CLO	Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	(SLT)
			L	T	P	O			
	Chapter 1: Introduction on software Process, Planning 1.1 Software scope	CLO1 CLO2 CLO3	1	1				2	4
	1.2 Software estimation techniques	CLO1 CLO2 CLO3	1	1				2	4
	1.3 software risk analysis technics	CLO1 CLO2 CLO3	1	1				2	4
	1.4 Software schedule management	CLO1 CLO2 CLO3	1	1				2	4
	Chapter 2: Software requirement and specification 2.1 Introduction	CLO1	3	2				2	7
	2.2 Classification of requirements	CLO1	3	2				2	7
	Chapter 3: Software architecture methods and design techniques 3.1 system structuring	CLO5	2	3				2	7
	3.2 Modular decomposition	CLO5	1	3				2	6
	3.3 control modelling	CLO5	2	3				2	7
	3.4 data abstraction	CLO5	2	3				2	7
	3.5 Refinement	CLO5	2	3				2	7
	3.6 Modular decomposition	CLO5	2	3				2	7
	Chapter 4: CASE tool and software development environment 4.1 Introduction	CLO6	2	3				2	7
	4.2introduce different software development tools	CLO6	2	3				2	7
	Chapter 5: Software testing 5.1 Introduction	CLO5	2	3				2	7
	5.2 software testing methods	CLO5	2	3				2	7
	Total								99

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test	20	2	4	6
2	Project	40		6	6
				Total	12
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		40	3	6	9
				Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software
		2	Computer lab, company visit
13	Textbook and reference:	1	Schach, S. R., Object Oriented and Classical Software Engineering, 7th edition, McGraw-Hill, 2007

		2	Pressman R. S. and Ince D., Software Engineering – A Practitioner's Approach, McGraw-Hill, 2007
		3	Sommerville, I., Software Engineering, 8th edition, Addison Wesley, 2006
		4	Thayer, R.H. and Christiansen, M. J., Software Engineering, Volume 1: The Development Process, 3rd edition, Wiley and Sons, 2005
		5	Rambaugh J., Jacobson I. and Booch G., The Unified Modeling Language Reference Manual Addison-Wesley, 2005

2.17.4.9 Introduction to Machine Learning

Addis Ababa Science and Technology University		
1	College: Electrical and mechanical engineering	Department: Electrical and computer engineering
	Course Name	Introduction to Machine Learning
	Course Code:	ECEg5407
3	Synopsis:	Machine learning uses interdisciplinary techniques such as statistics, linear algebra, optimization, and computer programming to create automated systems that can sift through large volumes of data at high speed to make predictions or decisions without human intervention. Machine learning as a field is now incredibly pervasive, with applications spanning from business intelligence to security, from analyzing biochemical interactions to structural monitoring of aging bridges, and from emissions to astrophysics, etc. This class will familiarize students with a broad cross-section of models and algorithms for machine learning and prepare students for research or industry application of machine learning techniques. The course provides students with an in-depth introduction to two main areas of Machine Learning: supervised and unsupervised. Main models and algorithms for regression, classification and clustering and will be covered. Topics will include linear and logistic regression, probabilistic (Bayesian) inference, SVMs and kernel methods, ANNs, clustering, and dimensionality reduction. To be eligible for this course, prior knowledge of python programming, familiarity with linear algebra, probability theory has to be first fulfilled.
4	Name(s) of Academic Staff:	Yehualashet Megersa Yehualashet.megersa@aastu.edu.et
5	Semester and Year offered:	Semester: I; Year: 5
6	Credit Hour:	3
7	Prerequisite/ Co-requisite:	

8 Course Learning Outcome (CLO): At the end of the course the student will be able to do:

CLO1	Synthesize the knowledge and skills gained from supervised and unsupervised learning algorithms within the design of a realistic Artificial intelligence (AI) agents.
CLO2	Evaluate learning algorithms and select the appropriate model that fulfills the required performance and efficiency using several Python distributions.
CLO3	Design and implement various machine learning algorithms in a range of real-world applications.
CLO4	Work collaboratively on a team to successfully complete a course project and develop presentation, report writing and problem-solving skills.
CLO5	Investigate real world problems and map them to the learning algorithms that possibly can solve.

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√		√				√	√	√
CLO2					√								√		√				√	√	√
CLO3			√										√		√				√	√	√
CLO4										√			√		√				√	√	√
CLO5		√											√		√				√	√	√

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Machine learning model developing, training, testing and deploying on real systems.
	2	Skills of implementing different machine learning tools and IDEs
	3…etc.	

11	Distribution of Student Learning Time (SLT)								
	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	Chapter 1: Introduction 1.1 What is machine learning?	CLO1	1					2	3
	1.2 Why machine learning	CLO1	1					2	3
	1.3 Problems machine learning can solve	CLO1	1					2	3
	1.4 Tools and categories of machine learning	CLO1	1					2	3
	Chapter 2: Supervised learning 2.1 Classification and regression	CLO1 CLO2 CLO3	2		2			2	6
	2.2 Supervised machine learning algorithms ➢ K-nearest Neighbor, ➢ Linear Models ➢ Naïve Bayes Classifiers ➢ Decision trees ➢ Support Vector Machine ➢ Neural networks (Deep learning)	CLO1 CLO2 CLO3	4		6			2	12
	Chapter 3: Unsupervised learning and preprocessing 3.1 Types of unsupervised learning	CLO1 CLO3 CLO5	2		2			2	4
	3.2 Pre-processing and scaling	CLO1 CLO3 CLO5	3		2			2	7
	3.3 Dimensionality reduction and feature extraction ➢ Principal component analysis (PCA)	CLO1 CLO3 CLO5	3		2			2	7
	3.4 Clustering ➢ K-means Clustering ➢ Agglomerative clustering ➢ Evaluating and comparing clustering algorithms	CLO1 CLO3 CLO5	4		4			2	8
	Chapter 4: Model evaluation and improvement 4.1 Cross-validation ➢ Benefits of cross validation ➢ Stratified K-fold cross-validation	CLO1 CLO2 CLO3	4		4			3	8
	4.2 Grid search	CLO1	2		2			3	7

➢ Simple grid search ➢ Grid search with cross validation	CLO2 CLO3							
4.3 Evaluation metrics and scoring ➢ Metrics for classification(Binaryand multi-class) ➢ Regression metrics ➢ Using evaluation metrics in model selection	CLO1 CLO2 CLO3	3		3			3	9
Chapter 5: Case study and course project	CLO1-5			6			3	9
Total								99

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test	20	1	4	5
2	Project	40		9	9
4	Choose an item.				
5	Choose an item.				14
				Total	

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	40	3	4	7
			Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software
		2	Computer lab
13	Textbook and reference:	1	Andreas C. Müller and Sarah Guido (October,2016) *Introduction to Machine learning with python,* First edition., : O' REILLY.
		2	Shai Shalev-Shwartz and Shai Ben-David (2014) *Understanding Machine Learning: From Theory to Algorithms*, First edn., Canada: Cambridge University Press.
		3	Ethem Alpaydın (2010) *Introduction to Machine Learning*, First edn., London: The MIT Press Cambridge, Massachusetts London, England

2.17.4.10 Advanced Computer Networks

Addis Ababa Science and Technology University		
1	College: Electrical and Mechanical Engineering	Department: Electrical Engineering
	Course Name	Advanced Computer Networks
	Course Code:	ECEg5410
3	Synopsis:	
4	Name(s) of Academic Staff:	Solomon Zemene
5	Semester and Year offered:	Semester: II Year: 5
6	Credit Hour:	3
7	Prerequisite/ Co-requisite:	Data Communications and Computer Networks (ECEg4406)
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Describe how different switching technologies are working and summarize TCP/IP layer concepts.
	CLO2	Describe basic services provided by data link layer
	CLO3	Demonstrate different network routing protocols and basic services provided by transport layer
	CLO4	Understand different application layer protocols such as http, mail, DNS and multimedia
	CLO5	Apply socket programming to program different network applications
	CLO6	Describe basic network management principles

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1					√								√				√	√			
CLO2					√								√		√		√				
CLO3			√		√								√		√				√		
CLO4					√								√		√				√		
CLO5		√	√	√	√								√		√					√	
CLO6					√								√								

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)
1	Socket programming skill
2	Different network application development skill

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F) L	T	P	O	Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT)
Chapter 1 Computer Networking Overview	CLO1	2		3			2	7
1.1 Packet Switch –Structure and Routing,	CLO1							
1.2 TCP/IP Model	CLO1							
Chapter 2 Data link layer	CLO2	4		6			6	16
2.1 Data link layer	CLO2							
2.2 Error detection	CLO2							

	2.3 Error correction	CLO2							
	2.4 Flow Control	CLO2							
	Chapter 3 Network Layer and Transport Layer	CLO3	6		9			8	23
	3.1 IPv6	CLO3							
	3.2 Routing Algorithms	CLO3							
	3.3 Transport Protocols (TCP and UDP)	CLO3							
	3.4 TCP flow control	CLO3							
	3.5 TCP Congestion control	CLO3							
	Chapter 4 Basics of Application layer	CLO4	8		12			8	28
	4.1 Application Layer Protocols	CLO4							
	4.2 The World Wide Web: HTTP	CLO4							
	4.3 Electronic Mail	CLO4							
	4.4 The Internet's Directory Service: DNS	CLO4							
	4.5 Multimedia	CLO4							
	Chapter 5 Introduction to Socket programming	CLO5	4		6			4	14
	5.1 Programs related to socket	CLO5							
	5.2 Socket Programming with TCP	CLO5							
	5.3 Socket Programming with UDP	CLO5							
	Chapter 6 Network Management	CLO6	4		6			4	14
	6.1 Overview of network management	CLO6							
	6.2 Access control mechanisms	CLO6							
	6.3 Layers of network management	CLO6							
	Total		28		42				70

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	5	1	1	2
2	Test	15	1	2	3
3	Assignments	10	0	3	3
4	Project	20	0	4	4
				Total	12

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		3	3	6
			Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room.)	1	Software
		2	Computer Lab

13	Textbook and reference: (note: ensure the latest edition)	1	Fourozon "Data Communication and Computer Networks" Tata Mcgraw Hill Publication.
		2	A. S. Tannenbaum " Computer Networks" Prentice Hall of India Publication
		3	Fred Halshall "Data Communication, Computer Networks and Open systems" Publication Pearson Education

2.17.4.11 VLSI Design

Addis Ababa Science and Technology University		
1	College: Electrical and mechanical engineering	Department: electrical and computer engineering
	Course Name	VLSI Design
	Course Code:	ECEg5405
3	Synopsis:	The course covers: Introduction to VLSI: Digital systems and VLSI; Gate Arrays; Standard Cells; Functional Blocks; CMOS Logic; Programmable ASICs: ASIC Library Design; Programmable ASIC Logic Cells; Programmable ASIC I/O Cells; Programmable ASIC Interconnect; Programmable ASIC Design Software; Hardware Description Languages: VHDL; Logic Synthesis: Timing Simulation and Verification; Placement and Routing; Layout Extraction.
4	Name(s) of Academic Staff:	Yonas Tesfaye yonas.tesfaye@aastu.edu.et
5	Semester and Year offered:	Semester: I — Year: 5
6	Credit Hour:	3
7	Prerequisite/ Co-requisite:	Computer Architecture and Organization (ECEg4103)
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Explain an IC and its production
	CLO2	Explain and analyze VLSI design cycles
	CLO3	Explain and analyze the design and fabrication of VLSI devices
	CLO4	Develop ICs using CMOS technology
	CLO5	Apply the knowledge of application specific integrated circuits in production of gates, multiplexers, counters and so on
	CLO6	Use VHDL programming to program hardware's
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assign	Project	Lab-report
CLO1			√														√				
CLO2			√	√													√				
CLO3			√	√	√												√				
CLO4			√	√	√												√		√		
CLO5			√	√	√												√		√		
CLO6			√	√	√												√			√	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	
	3…etc.	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			

	Chapter 1: Introduction 1.1 What is IC?	CLO 1	1				√	2	3
	1.2What are the importance's of IC	CLO 1	1				√	2	3
	1.3 Evolution of IC	CLO 1	1				√	2	3
	1.4 Applications and products of IC	CLO 1	1				√	2	3
	Chapter 2: VLSI design 2.1 Introduction	CLO 2	1				√	2	3
	2.2 IC development history (speed and size)	CLO 2	1				√	2	3
	2.3 VLSI design cycle ➢ System specification ➢ Architectural design ➢ Behavioral/functional design ➢ Logic design ➢ Circuit design ➢ Physical design ➢ Fabrication ➢ Packaging, testing and debugging	CLO 2	2				√	2	4
	2.4 Design style ➢ Full custom ➢ Standard cell ➢ Gate array ➢ Field programmable gate array ➢ Comparison of all styles based on cost, area, performance, and interconnection	CLO 2	2				√	2	4
	2.5 RISC and CISC processors	CLO 2	1				√	2	3
	2.6 Assembly programming	CLO 2	2		3		√	2	7
	2.7 Assembly programming with 8086 emulators	CLO 2	2		3		√	2	7
	Chapter 3: Design and fabrication of VLSI devices 3.1 Introduction to how to manufacture chip	CLO 3	1				√	2	3
	3.2 Chip fabrication materials	CLO 3	1				√	2	3
	3.3 Transistor fundamentals ➢ TTL ➢ MOS (nMOS, pMOS, CMOS)	CLO 3	2				√	3	5
	3.4 Fabrication of VLSI circuits ➢ Create ➢ Define ➢ Etch ➢ nMOS and CMOS fabrication process	CLO 3	2				√	3	5
	3.5 Details of fabrication process ➢ Crystal growth and wafer	CLO 3	3				√	3	6

	preparation ➢ Epitaxy ➢ Dielectric and polysilicon deposition ➢ Oxidation ➢ Diffusion ➢ Ion implantation ➢ Lithography ➢ Metallization ➢ Etching ➢ Planarization ➢ Packaging								
	3.6 Design rules (size, separation and overlap)	CLO 3	1				√	3	4
	3.7 layout of basic devices ➢ Invertors ➢ NOR ➢ NAND	CLO 3	2				√	2	4
	Chapter 4: CMOS 4.1 CMOS circuit basics	CLO 4	2				√	2	4
	4.2 nMOS transistor	CLO 4	1				√	2	3
	4.3 Transistor switching characteristics	CLO 4	1				√	2	3
	4.4 Transistor digital behavior	CLO 4	1				√	2	3
	4.5 MOS terminal voltages	CLO 4	1				√	2	3
	4.6 Push-pull logic	CLO 4	1				√	2	3
	4.7 Logic gates in CMOS ➢ Invertor ➢ NAND ➢ NOR ➢ Three input NAND, NOR, AND	CLO 4	2				√	2	4
	Chapter 5: Application specific integrated circuits 5.1 Introduction to ASIC	CLO 5	1				√	2	3
	5.2 Types of ASIC ➢ Full custom ➢ Semi-custom (standard cell base and gate array based) ➢ Programmable (PLDs and FPGAs)	CLO 5	1				√	2	3
	5.3 Basic logic cells ➢ Multiplexer base ➢ Look-up table based ➢ Programmable based	CLO 5	2				√	2	4
	Chapter 6: Logic synthesis 6.1 Introduction	CLO 6	1				√	2	3
	6.2 Why we need logic optimization	CLO 6	1				√	2	3
	6.3 Introduction to VHDL ➢ Standard logic package	CLO 6	3		3		√	2	8

	➢ Entity ➢ Architecture ➢ Signal declaration ➢ Mapping ➢ Signal assignment ➢ Process								
	6.4 VHDL programming ➢ Synchronous and asynchronous reset ➢ Multiplexer ➢ Adder ➢ Counter ➢ Decoder ➢ Sequential logic ➢ Finite state machine (FSM)	CLO 6	3		6		√	2	11
	6.5 VHDL synthesis flow ➢ RT level synthesis ➢ Logic synthesis ➢ Technology mapping	CLO 6	3		2		√	2	7
	6.6 Timing consideration ➢ Propagation delay ➢ Synthesis with time constraint ➢ Timing hazards ➢ Dealing with hazards	CLO 6	2				√	2	4
	Total								120

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test	10			
2	Assignment	20			
3	Project	30			
				Total	
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		40			120
				Grand Total SLT	

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software's like VIVADO for VHDL or Verlog
		2	Computer lab
13	Textbook and reference:	1	Digital Integrated Circuits, Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic.
		2	Application-Specific Integrated Circuits, 1997, M. John, S. Smith
		3	Modern VLSI Design – System-on-Chip Design, Prentice Hall, 2002,Wayne Wolf
		4	Principles of CMOS VLSI Design Neil H. E. Weste, et al.
		5	HDL Chip Design, Donne Publishing, 1996, J. Smith

2.17.5 Control Engineering Focus Area Courses

2.17.5.1 Industrial Automation

Addis Ababa Science and Technology University		
1	College: Electrical and Mechanical Engineering	Department: Electrical and Computer Engineering
2	Name of Course:	Industrial Automation
	Course Code:	ECEg4508
3	Synopsis:	A review and analysis of relay logic and programmable logic controllers; Programming, installation and troubleshoot PLC modules; Analyze industrial networking protocols, Design DCS and SCADA systems for industrial automations.
4	Name of Academic Staff:	Hamdihun Abdie
5	Semester and Year offered:	Semester: II Year: 4
6	Credit Hour:	4 (Lec 2hrs; Tut 3hrs; Lab 3hrs)
7	Prerequisite/Co-requisite	Electrical Workshop II (ECEg4107)/ Microprocessors and Interfacing (ECEg4102)
8	Course Learning Outcome (CLO): At the end of the course the student will be able to:	
	CLO1	Analyze industrial automation problems: the necessity of programmable logic controller over relay logic controllers.
	CLO2	Program and troubleshoot PLC modules both with analog and digital devices.
	CLO3	Analyze data communication and computer networking, and their application for industrial automation.
	CLO4	Apply DCS and SCADA systems for industrial automation problems.
9	Mapping of the Course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PLO)												Teaching Methods				Assessment				
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	L	T	P	O	Test	Quiz	Assignme	Project	Lab-report
CLO1						√											√				
CLO2					√														√		√
CLO3		√															√	√			
CLO4			√		√															√	√

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Programming skills
	2	Group working skills

11	Distribution of Student Learning Time (SLT)								
	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			

	Chapter 1: Introduction to Industrial Automation 1.1 Industrial revolutions 1.2 Introduction to Relay control system 1.3 What is relay 1.4 How relay logic Works 1.5 Relay Logic Circuits 1.6 Control panel: Choosing between Relay Logic control and PLC	CLO1	4	6				4	14Hrs
	Chapter 2: Programmable Logic Controller 2.1 PLC components 2.2 PLC Programming Languages 2.3 Ladder Diagram (LAD) Programming 2.4 Elements of Ladder Diagram 2.5 PLC Digital Programming 2.6 Timers/Counters 2.7 PLC Analog Programming 2.8 Conversion Operation 2.9 PLC Compare Instruction 2.10 Advanced PLC Programming 2.11 Human Machine Interface (HMI) Programming	CLO2	6	6	9		2	4	27Hrs
	Chapter 3: Installation of PLC Modules and Troubleshooting 3.1 Configuring PLC Modules 3.2 PLC with actuators: Electric, Pneumatic and Hydraulic actuators 3.3 PLC and Actuators Wiring 3.4 Programming actuator control with FluidSIM 3.4 Troubleshooting of PLC system	CLO2	4	3			2		9Hrs
	Chapter 4: Introduction to Data Communications and Computer Networking 4.1 Physical layer 4.1.1 Data and signals 4.1.2 Digital transmission (Digital to digital and analog to digital) 4.1.3 Multiplexing (frequency, wavelength, and time division multiplexing) 4.1.4 Switching (circuit and packet switching) 4.2Datalink layer 4.2.1 Error detection and correction 4.2.2 Multiple access (CSMA/CD, CSMACA), (FDMA, CDMA) 4.2.3 Wired LAN (Ethernet) 4.3Network layer 4.3.1 Logical addressing (IPv4 addressing) 4.3.2 Internet protocol 4.3.3 Address mapping and error reporting (ARP, DHCP,RARP,ICMP) 4.3.4 Forwarding and routing 4.4Transport layer	CLO3	6	9	6		2	4	27Hrs

	4.4.1 Process to process delivery (UDP and TCP) 4.4.2 Congestion control and quality of service 4.5Application layer 4.5.1 Domain name system (DNS) 4.5.2 Electronic mail and file transfer (SMTP and FTP) 4.5.3 WWW and HTTP								
	Chapter 5: DCS and SCADA Systems 5.**1** Basics of SCADA systems 5.**2** Data acquisition 5.**3** Elements of data acquisition systems 5.**4** Industrial control networks 5.**5** SCADA protocols and communication trends 5.**6** Hardware and software requirements of SCADA system 5.**7** Distributed Control System (DCS) 5.**8** Comparison of DCS and SCADA Systems 5.9 Programming SCADA Systems	CLO4	6	9	9		4	2	30Hrs
	Chapter 6: Industrial Applications of SCADA Systems: Project Based	CLO4	4		6			9	19Hrs
	Total								126Hrs

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	15%	√		3Hrs
2	Assignments	10%		√	9Hrs
3	Quiz	5%	√		1Hrs
4	Project	20%		√	18Hrs
				Total	34Hrs

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50%	√		3Hrs
			Grand Total SLT	160Hrs

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non-Face to Face

12	Special requirements and resources to deliver the course	1	Software: Siemens Step 7 V13, WinCC, SCADA software
		2	Laboratory
		3	Industry Visit
13	Textbooks and references:		1.Introduction to PLC programming and Implementation: from Relay logic to PLC logic, Industrial Text and Video Company 1-800-752-8398 2.Mohammad Shahidehpour, Yaoyu Wang, Communication and Control in Electric Power Systems: Applications of Parallel and Distributed Processing, Wiley-IEEE Press, 2003. 3.Dr.M.K Khedkar Electrical Power Distribution automation,2010 4.J. Duncan Glover Mulukutla Sarma : Power System Analysis and Design, SI Version,2012. 5.Stanley H. Horowitz, Arun G. Phadke , Power System Relaying, third edition,2008 6. Rajesh Mehra, PLCs and SCADA : Theory and Practice,2011 K S Manoj, Industrial Automation with SCADA: Concepts, Communications and Security,2019

2.17.5.2 Modern Control Systems

Addis Ababa Science and Technology University		
1	College: Electrical and Mechanical Engineering	Department: Electrical Engineering
2	Course Category	Core Module
	Course Name	Modern Control Systems
	Course Code:	ECEg4510
3	Synopsis:	Review of the linear spaces and operators, mathematical modelling, state space representation and canonical forms, controllability, observability, realization of transfer function, and solution of the state equation. Applications include stability concepts and definitions. Lyapunov's Direct Method, design of the state and output feedback control systems, eigen-spectrum assignment, and state estimator design, introduction to non-linear control systems.
4	Name(s) of Academic Staff:	
5	Semester and Year offered:	Semester: II Year: 4
6	Credit Hour:	4
7	Prerequisite/ Co-requisite:	Introduction to Control Systems (ECEg4105)
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Analyze the principles and concepts of Modern control system
	CLO2	Analyze the mathematical modeling of control Systems, Stability, Controllability, and Observability of control system
	CLO3	Design of Modern type control systems using state space method and different techniques and apply MATLAB and Simulink.
	CLO4	Work collaboratively on a team to successfully complete a design project
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√	√			√	√	√	√	
CLO2	√												√	√			√	√	√	√	
CLO3				√									√	√	√					√	√
CLO4									√							√			√	√	

Indicate the relevancy between the CLO and PO by ticking "√" on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	MATLAB/Simulink Software skill, Mathematical analysis skill
	2	Teamwork Skill
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities			Total (SLT)
		Guided learning (F2F)	Guided Learning (NF2F)	Independent Learning (NF2F)	

		L	T	P	O			
Chapter 1: Mathematical Modeling of dynamic systems in State Space 1.1 Introduction 1.2 State Variables of a dynamic system 1.3 State Space representation of dynamic systems 1.4 Signal flow graph and block-diagram models 1.5 The transfer functions from the state equation. 1.6 The time response and the state transition matrix. 1.7 Controllability and Observability.	1,2	6	6	4		4	6	26
Chapter 2: Design of control systems in state space. 2.1. Introduction 2.2 Full-state feedback control design 2.3 Observer design 2.4 Integrated full-state feedback and observer	3,4	6	8	4		2	4	24
Chapter 3: Introduction to non-linear systems 3.1 Introduction to non-linear control systems 3.2 Phase Plane Analysis covering 3.3 General describing functions of common nonlinearities 3.4 Lyapunov's direct method 3.5 Type of Nonlinear Control System	1,2, 3	6	5	5		4	8	28
Chapter 4: Introduction to Optimal Control System 4.1 Introduction to Optimal Control Problem and classifications 4.2 The parameter optimization by the method of Lagrange multipliers in optimal control problem 4.3 Linear Quadratic Optimal Control Problem (The Algebraic Riccati equation)	2,3	8	5	4		5	10	32
Total		26	24	17		15	28	110

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	5	√		1 hr
2	Tests	10	√		2 hrs
3	Assignments	10		√	2 hrs
4	Project	15		√	4 hrs
5	Lab-report	10		√	3 hrs

<table>
<tr><td rowspan="4"></td><td colspan="5" align="right">Total</td><td>12</td></tr>
<tr><td colspan="2">Final Exam</td><td>Percentage 50 (%)</td><td>F2F</td><td>NF2F</td><td>SLT</td></tr>
<tr><td colspan="2">Final Exam</td><td>50 %</td><td>√</td><td></td><td>3 hrs</td></tr>
<tr><td colspan="5" align="right">Grand Total SLT</td><td>167 hrs</td></tr>
<tr><td></td><td colspan="6">L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO’s numbering in item 9.</td></tr>
<tr><td rowspan="3">12</td><td rowspan="3">Special requirements and resources to deliver the course</td><td>1</td><td colspan="4">Computer Lab</td></tr>
<tr><td>2</td><td colspan="4">Software</td></tr>
<tr><td>3</td><td colspan="4">Simulation Room</td></tr>
<tr><td rowspan="8">13</td><td rowspan="8">Textbook and reference:</td><td>1</td><td colspan="4">Richard C. Dorf, Robert H Bishop: Modern Control Systems (10th Edition), Prentice Hall; 10 edition (April 8, 2004).</td></tr>
<tr><td>2</td><td colspan="4">Jene F. Franklin and others, “Digital Control of Dynamic systems” Addison-Wesley publishing company, second Edition.</td></tr>
<tr><td>3</td><td colspan="4">Katsuhiko Ogata: Modern Control Engineering, Prentice Hall; 4 edition Nov 13, 2001.</td></tr>
<tr><td>4</td><td colspan="4">John J. D’ Azzo and Houpis: Feedback Control system analysis and synthesis.</td></tr>
<tr><td>5</td><td colspan="4">Richard C. Dorf, Robert H BishopModern Control Systems (9th Edition), Prentice Hall; 9th edition (August 3, 2000).</td></tr>
<tr><td>6</td><td colspan="4">I.J. Nagrath and Gopal: Control System Engineering by, 2001</td></tr>
<tr><td>7</td><td colspan="4">Benjamin C. Kuo today “Digital Control Systems</td></tr>
<tr><td>8</td><td colspan="4">Charles L. Phillips & H. Troy Nagle, Digital Control System Analysis and Design</td></tr>
</table>

2.17.5.3 Instrumentation Engineering

Addis Ababa Science and Technology University						
1	College: Electrical and Mechanical Engineering			Department: Electrical Engineering		
2	Course Category	Core Module				
	Course Name	Instrumentation Engineering				
	Course Code:	ECEg5502				
3	Synopsis:	Basic physical principles of measurement and instrumentation, Standards and organizations, Advanced sensor technology, Telemetry applications, Introduction to intelligent and smart instrumentation				
4	Name(s) of Academic Staff:					
5	Semester and Year offered:	Semester:	II	Year:	5	
6	Credit Hour:	3				
7	Prerequisite/ Co-requisite:	Electrical Measurement and Instrumentation (ECEg3110) Microprocessors and Interfacing (ECEg4102)				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Understand and analyze basic instrumentation systems				
	CLO2	Apply and analyze advanced sensors				
	CLO3	Design instrumentation systems for Telemetry applications				
	CLO4	Apply and analyze intelligent and Virtual instrumentation systems on software				
	CLO5	Work collaboratively on a team to successfully complete a design project				

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assign ment	Project	Lab-report
CLO1	√												√		√		√				√
CLO2		√											√		√				√	√	√
CLO3			√										√		√		√		√	√	√
CLO4				√									√		√		√		√	√	√
CLO5									√												

Indicate the relevancy between the CLO and PO by ticking "√" on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1	Instrument/Equipment Usage skill
2	
3…etc.	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			

	Chapter 1: Basic physical principles of measurement and instrumentation General Principles of Instrumentation 1.2 Sensors and Applications Signal Conditioning and Conversion Circuits 1.4 Output Presentation	1	4		9		2	4	19
	Chapter 2: Standards and Organizations 2.1What is standard? Need for standard? 2.2Existing standard organization Quality assurance	1	2				1	1	4
	Chapter 3: Advanced sensor technology 3.1 Basic Sensor Technology 3.2Sensor Systems 3.3Application Considerations 3.3.1. Sensor Characteristics 3.3.2. System Characteristics 3.3.3. Instrument Selection 3.4 Measurement Issues and Criteria 3.5 Sensor Signal Conditioning 3.5.1. Conditioning Bridge Circuits 3.5.2. Amplifiers for Signal Conditioning 3.5.3. Signal Conditioning High Impedance Sensors 3.6. Analog to Digital Converters	1, 2	8		9		4	6	27
	Chapter 4: Telemetry Applications 4.1Telemetry Systems Overview 4.2Data Acquisition 4.3Multiplexer 4.4 Modulation 4.5 Commutation 4.6 Frame synchronization pattern 4.7 PCM Stream Reconstruction 4.8 De-commutation 4.9 Encoding	3	8		12		4	8	32
	Chapter 5: Introduction to intelligent and Smart instrumentation 5.1 Introduction to intelligent instrumentation 5.2 Historical Perspective and Current status 5.3 software-based instruments 5.4 Virtual Instrumentation	4, 5	6		12		2	4	24
	Total								106 hrs

	Assessment					
	Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
	1	Assignments	10		√	4
	2	Lab-report	5		√	2
	3	Project	20		√	4
	4	Tests	15	√		1
					Total	11 hrs
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50	√		3 hrs
					Grand Total SLT	120 hrs
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					
12	Special requirements and resources to deliver the course	1	Software			
		2	Computer Lab			
		3	Simulation Room			
		4	Workshop			
13	Textbook and reference:	1	P.H.Garrett ,Advanced Instrumentation and Computer I/O Design			
		2	J.P.Bentley, Principles of Measurement Systems			
		3	IEEE–Transactions of Instrumentation and Control			
		4	IEEE–Transactions Control and Instrumentations			
		5	Video tutorials			
		6	Webinars			

2.17.5.4 Artificial Intelligence for Control Engineering

Addis Ababa Science and Technology University		
1	College: Electrical and Mechanical Engineering	Department: Electrical Engineering

2	Course Category	Core Module
	Course Name	Artificial Intelligence for Control Engineering
	Course Code:	ECEg5510
3	Synopsis:	Analysis of introduction to Artificial Intelligence; classical set theory, fuzzy set theory, and design. And analysis of artificial neural network and its design, basic learning processes in artificial neural networks.
4	Name(s) of Academic Staff:	Lidia Habtamu
5	Semester and Year offered:	Semester: II Year: 5
6	Credit Hour:	3
7	Prerequisite/ Co-requisite:	

8 Course Learning Outcome (CLO): At the end of the course the student will be able to do:

CLO1	Explain and differentiate classical set theory and fuzzy set theory
CLO2	Design of fuzzy set theory and Basic learning processes of Artificial neural networks
CLO3	Analysis of fuzzy logic control and learning processes of Artificial Neural networks
CLO4	Apply and evaluate Fuzzy logic control systems and Artificial Neural networks

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	project	Lab-report
CLO1		√											✓	✓				✓			
CLO2			✓										✓	✓	✓		✓		✓	✓	
CLO3				✓									✓	✓	✓		✓		✓	✓	
CLO4					✓									✓	✓						✓

Indicate the relevancy between the CLO and PO by ticking "√" on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1	Skill of MATLAB Simulink Fuzzy logic and Artificial Neural Networks toolbox
2	
3…etc.	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Classical and Fuzzy Set Theory 1.1 Classical Sets, Fuzzy set and Fuzzy logic	CO1	2				2	4	8
1.2 Fuzzy relations	CO1							
1.3 Fuzzy implications	CO1							

	1.4 the theory of approximate reasoning	CO1							
	Chapter 2: Fuzzy rule-based systems and controllers 2.1 Fuzzy rule-based systems	CO2 and CO3	6		10		3	4	23
	2.2 Fuzzy reasoning scheme	CO2 and CO3							
	2.3 Fuzzy Logic Controllers	CO2 and CO3							
	Chapter 3: Fuzzy logic applications 3.1 Fuzzy logic control applications (project based)	CO4	7.5		11		4	8	30.5
	Chapter 4: Neural networks Fundamentals 4.1 Essentials of Artificial Neural Networks	CO1, CO2 and CO3	4		10		2	6	23
	4.2 Single layer Feed forward Neural Networks	CO1, CO2 and CO3							
	4.3 Multi-layer Feed-forward Neural Networks Associative memories 4.4Supervised machine learning 4.5 Gradient descent and back propagation 4.6 Convolutional Neural Networks 4.7 Recurrent Neural Networks	CO1, CO2 and CO3							
	Chapter 5: Neural Network applications 5.1 Application of Artificial Neural Networks (Project based)	CO4	6		11		3	8	28
	Total	25.5			42		14	36	112.5

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	5	0.5		0.5
2	Tests	15	1		1
4	Assignments	10		1	1
5	Projects (1-Individual and 1-Group)	20		1	1
				Total	4.5
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	3		3
				Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software
		2	Computer Lab
13	Textbook and reference:	1	Chennakesava R. Alavala, Fuzzy logic and Neural Networks Basic Concepts and Applications, New Age International Publisher
		2	Nikola K. Kasabov, Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, 1998

2.17.5.5 Process Control Fundamentals

Addis Ababa Science and Technology University					
1	College: Electrical and Mechanical Engineering		Department: Electrical Engineering		
2	Course Category	Core Module	Course Code: ECEg4506		
	Name of Course:	Process Control Fundamentals			
z3	Synopsis:	A review and analysis of fundamental process control; cascade control, ratio control, dead time control, feedforward control, selective and override control. The course deals with PID controller design and tuning techniques: Model predictive control and modelling; Multivariable and Non-linear control: Applications fuzzy logic for process control.			
4	Name(s) of Academic Staff:	Hamdihun Abdie			
5	Semester and Year offered:	Semester:	II	Year:	4
6	Credit Hour:	3			
7	Prerequisite	Introduction to Control Systems (ECEg4105)			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Understand fundamental process control methods and techniques.			
	CLO2	Design and tune PID, Model Predictive controllers for process control applications and evaluate the performance.			
	CLO3	Analyze practical process control strategies.			
	CLO4	Apply computers in process control.			
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:				

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√	√			√				
CLO2			√										√	√				√			
CLO3			√										√	√			√		√		
CLO4				√									√	√				√	√		

10	Transferable Skills (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
	2	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Introduction to Process Control 1.1 Definition and basic terminologies of process control 1.2 Representative process control problems and illustrative examples	CLO1	4				3	5	12

	1.3 Process and Instrumentation diagrams (Pand ID) 1.4 Classification of process control strategies 1.5 Basic process control modes 1.6 Process dynamics modelling								
	Chapter 2: PID Controller and Tuning Techniques 2.1 PID controller and Design 2.2 Tuning techniques 2.2.1 Closed loop oscillation-based tuning 2.2.2 Zeigler-Nicholes method 2.2.3 Tyreus and Luyben tuning method 2.2.4 Cohen-Coon parameters 2.2.5 Direct synthesis Methods 2.2.4 PID design and tuning based on IMC	CLO2	8	4	10		3	8	33
	Chapter 3: Practical Control Strategies 3.1 Cascade control 3.2 Feed-forward control 3.3 Feedforward and feedback compensation (Hybrid) 3.4 Ratio control 3.5 Selective and over-ride control 3.6 Process dead time compensation	CLO3	8	5	10		4	8	35
	Chapter 4: Advanced Control Methods in Process Control 4.1 Model predictive control 4.1.1 Overview of Model Predictive Control 4.1.2 Predictions for SISO Models 4.1.3 Model Predictive Control Calculations, Set-Point Calculations 4.1.4 Selection of Design and Tuning Parameters for MPC 4.1.5 Implementation of MPC 4.2 Multivariable control 4.3 Nonlinear Control	CLO3	8	5	8		4	8	33
	Total		28	14	28		14	36	113

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	25%	1.5		1.5
2	Assignments	20%		2	2
3	Quiz	5%	0.5		0.5
				Total	4

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50	3		3
			Grand Total SLT	120Hrs

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non-Face to Face

12	Special requirements	1	Software	MATLAB/Simulink

	and resources to deliver the course	2	Computer Lab
13	Textbook and reference:	1	Seborg, D., Edgar F., Mellichamp D., Process Dynamics and Control, John Wiley, 4th ed., New York 2016.
		2	William L. Luyben, Process Modeling, Simulation and Control for Chemical Engineers, Second Edition 1999.
		3	BABATUNDE A. OGUNNAIKE, Process dynamics, modeling, and control, New York Oxford. Oxford University Press, 1994.
		4	McGraw-Hill Chemical Engineering Series, Process Systems Analysis and Control.

2.17.5.6 Robotics and Computer Vision

Addis Ababa Science and Technology University						
1	College: Electrical and Mechanical Engineering			Department: Electrical Engineering		
2	Name of Course:	Robotics and Computer Vision				
	Course Code:	ECEg5511				
3	Synopsis:	This course mainly provides students with the knowledge and skills required to analyze different robot functions, digital images, and video to extract vital information buried in them. The students will have the ability to use robot for industrial product effectiveness and simplification of human burden and they will have also the ability to apply theories and algorithms for real life applications such as face recognition, video surveillance and visual traffic management.				
4	Name(s) of Academic Staff:	Hamdihun Abdie				
5	Semester and Year offered:	Semester:	I	Year:	5	
6	Credit Hour:	4				
7	Prerequisite	Introduction Control Systems (ECEg4105), Engineering Mechanics-II (Dynamics) (MEng2104)				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Identify different actuators and sensors to build a robot and extract information inside image and video.				
	CLO2	Examine kinematics, dynamics of robots and analyze computer vision algorithms using MATLAB, Maple and OpenCV.				
	CLO3	Design a controller, construct, assemble robot and implement computer vision for real life application.				
	CLO4	Work collaboratively on a team to successfully complete a design project.				
9	Mapping of the Course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes (CLO)	Program Learning Outcomes (PLO)																				
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√				√				
CLO2					√								√	√	√		√		√		√

	CLO3			√										√	√	√			√	√		√
	CLO4									√						√					√	

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Programming skills
	2	Group working skills
	3	Mathematical modelling and design skills

11	Distribution of Student Learning Time (SLT)								
	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	Chapter 1: Fundamentals of Robot 1.1 Introduction to Robots 1.2 Robot anatomy, Robot Parts, and their functions 1.3 Work Envelop, Co-ordinate system, Pitch, Yaw, Roll, Joint Notations 1.4 Speed of Motion, Pay Load. 1.5 End effectors and grippers 1.6 Selection and Design Considerations of Gripers 1.7 Two Fingered and Three Fingered Grippers 1.8 Internal Grippers and External Grippers	CLO1	4	3				3	10Hrs
	Chapter 2: Sensor and Machine Vision 2.1 Requirements of a sensor 2.2 Principles and Applications of the following types of sensors 2.2.1 Position of sensors 2.2.2 Range sensors 2.2.3 Range finders 2.2.4 Proximity sensors 2.2.5 Touch sensors 2.2.6 Wrist sensors 2.3 Signal Conversion 2.4 Image Storage and Lighting Techniques, Applications.	CLO1	4	3			2	3	16Hrs
	Chapter 3: Robot Kinematics 3.1 Forward Kinematics 3.2 Inverse kinematics and differences 3.3 Jacobian and singularity configuration, 3.4 Differential kinematics velocity and acceleration	CLO2	4	9	4		2	4	27Hrs

3.5 DH Matrix – derivation and problems								
Chapter 4: Robot Dynamics and Control 4.1 Motion control 4.2 Kinematic control 4.3 Trajectory generation 4.4 Dynamics control 4.5 Speed control 4.6 Torque control.	CLO2	4	6	6		2	2	24Hrs
Chapter 5: Introduction to Computer Vision 5.1 Define computer vision 5.2 Digital image 5.3 Image representation 5.4 Video – some feature 5.5 Image and video acquisition devices 5.6 Image handling and format types 5.7 Color perception – color spaces 5.8 RGB color space filter	CLO3	4	6	3		4		17Hrs
Chapter 6: Image and Video Analysis ***6.1 Image Analysis*** 6.1.1 Relevant features 6.1.2 Histogram of an Image 6.1.3 Edge extraction – implementation of Sobel 6.1.4 Robert and Prewitt operator 6.1.5 Image convolution 6.1.6 Binary Morphology operator 6.1.7 Image conversion 6.1.8 Limitation of 2D images 6.2 ***Video Analysis*** 6.2.1 Frames - resolution of video 6.2.2 Background subtraction 6.2.3 Frame differencing, object detection 6.2.4 Motion tracking	CLO3	6	9	6		2		31Hrs
Chapter 7 Application of Computer Vision 7.1 Face detection 7.2 Face recognition algorithm – Viola Jones Algorithm 7.3 Face recognition algorithm in OpenCV 7.4 Car counting 7.5 Traffic congestion management using video analysis 7.6 Video Surveillance.	CLO4	4	6	6		8	3	33Hrs
	Total	30	45	22		20	12	129Hrs

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	10%	√		2Hrs
2	Quiz	5%	√		1Hrs
3	Assignments	10%		√	6Hrs

	4	Project	15%		√	10Hrs	
	5	Lab-report	10%		√	9Hrs	
						Total	28Hrs
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT	
	Final Exam		50%	√		3Hrs	
						Grand Total SLT	160Hrs
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non-Face to Face						

12	Special requirements and resources to deliver the course	1	Software: MATLAB/Simulink, Maple, SOLIDWORKS 3D CAD
		2	Computer Lab
		3	Workshop : Mechanical Design Workshop
13	Textbooks and references:		Craig, John (2017). 'Introduction to Robotics', Mechanics and Control, Fourth Edition. Addison- Wesley Publication. Mittal R. K., Nagrath I. J., (2003) 'Robotics and Control' Tata McGraw-Hill Publishing Company Ltd., New Delhi, pp 451-460. L. Shapiro and G. Stockman, Computer Vision – Prentice Hall D. Forsyth and J. Ponce, Computer Vision: A Modern Approach -Prentice Hall Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey., 'Industrial Robotics' McGraw-Hill International Editions R. Hartley and A. Zisserman, Multiple View Geometry – Cambridge Univ. Press M. Tekalp, Digital Video Processing – Prentice Hall A. Bovik, The essential guide to Video Processing – Elsevier Academic Press

2.17.5.7 Digital Control Systems

Addis Ababa Science and Technology University		
1	College: Electrical and Mechanical Engineering	Department: Electrical Engineering
	Course Name	Digital Control Systems
	Course Code:	ECEg5507
3	Synopsis:	The course deals with the theory on the design of digital control systems and their implementation. Major topics include: State-space system model. Discrete-time signals and systems; z-transform. Sampling: the ideal sampler, data reconstruction, quantization effects. Discrete equivalents to continuous-time transfer functions. Stability analysis: Jury's stability test; root locus; Nyquist stability criterion. Design of digital control systems: transform techniques; stat-space techniques. Hardware and software aspects in implementation. Laboratory work will include experiments on PID controller, and sate feedback controller design of an electro-mechanical system.
4	Name(s) of Academic Staff:	Hamdihun Abdie Hamdihun.abdie@aastu.edu.et
5	Semester and Year offered:	Semester: I Year: 5
6	Credit Hour:	3
7	Prerequisite/ Co-requisite	Modern Control Systems (ECEg4510)/Embedded Systems (ECEg5403)

8 Course Learning Outcome (CLO): At the end of the course the student will be able to do:

CLO1	Use control engineering knowledge to understand and design digital control systems
CLO2	Develop and analyze mathematical models for digital control systems design
CLO3	Design digital PID controller and digital state feedback controllers
CLO4	Design and implement various digital controllers using MATLAB to control a DC motor

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√				√				
CLO2		√											√				√	√	√		
CLO3			√										√		√					√	√
CLO4				√									√		√					√	√

Indicate the relevancy between the CLO and PO by ticking "√" on the appropriate relevant box

10 Transferable Skills
(Skills learned in the course of study which can be useful and utilized in other settings)

1	MATLAB Programming
2	Digital controller programming and usage

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Introduction 1.1 Comparison of digital and analog control systems 1.2 overview of the control	CLO1	1hr					5hr	6

	problem and design approach.								
	Chapter 2: Mathematical Models for Discrete-Time Systems 2.1 Linear difference equation 2.2 Z-transform and properties discrete transfer function systems with delay.	CLO1	3hr	3hr				5hr	16
	Chapter 3: Sampling and Reconstruction 3.1 Sample and hold spectrum of sampled signals 3.2 Nyquist sampling theorem and aliasing data reconstruction.	CLO1	3hr	3hr				3hr	16
	Chapter 4: Analysis of Discrete-Time Signals and Systems 4.1 discrete-time signals response of discrete-time systems 4.2 stability analysis techniques (Jury stability criterion root locus Nyquist criterion) 4.3 transient and steady state characteristics.	CLO2	3hr	3hr	3hr			3hr	19
	Chapter 5: State-Space System Model 5.1 Concept of states, state variables, state vector, state space 5.2 state-space equations 5.3 modeling of physical systems using state-space models 5.4 stability, controllability, and observability 5.5 similarity transformation canonical forms 5.6 discrete-time state-space models (with and without input delay).	CLO2	8hrs	6hr	6hr			5hr	30
	Chapter 6: Design using Transform Techniques 5.1 Emulation of continuous-time design (discrete equivalents by Numerical integration/differentiation hold equivalents and zero-pole mapping) 5.2 PID control direct digital design: z-plane design using root locus frequency domain design with w-transform.	CLO3	3hr	3hr	6hr		3hr	5hr	19
	Chapter 7: State Space Design 7.1 Regulator design using pole placement technique 7.2 Ackermann formula observer design	CLO3	6hr		6hr			5hr	19

	7.3 reduced-order observer, servo control system design 7.4 robust control and disturbance rejection actuator and sensor delays.								
	Chapter 8: Implementation and Practical Consideration, Sample rate selection, supporting hardware and software effects of quantization.	CLO4	1hr		3hr			1hr	5
	Total		28	18	24		3	32	105

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	10	√		2
2	Quiz	5	√		1
3	Assignments	10	√		3
4	Lab-report	10	√		3
5	Project	15	√		3
				Total	
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	√		3
				Grand Total SLT	120

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software
		2	Computer Lab
		3	Laboratories
13	Textbook and reference:	1	Digital Control System Analysis and Design, Fourth Edition, Global Edition Charles L. Phillips, H. Troy Nagle, Aranya Chakrabortty, 2015
		2	Digital Control Systems-Theoretical Problems and Simulation Tools, Anastasia Veloni, Nikolaos I. Miridakis, 2018
		3	Analog and digital Control System Design- Transfer function, state space and algebraic methods, Chi-Tsong Chen
		5	Lecture Notes

2.17.5.8 Embedded Systems for Control Engineering

Addis Ababa Science and Technology University						
1	College: Electrical and mechanical		Department: Electrical and computer			
	Course Name	Embedded Systems for Control Engineering				
	Course Code:	ECEg5503				
3	Synopsis:	This course is designed to provide students a working knowledge of Embedded Systems their Design and Programming at an Introduction level. In this course the fundamentals of embedded systems, hardware and firmware designs will be explored. Issues such as embedded microcontrollers, embedded programs, real-time operating systems, low power computing, embedded systems implementations as well as optimization, internet of things, and some projects of embedded systems will be discussed.				
4	Name(s) of Academic Staff:	Yonas Tesfaye Yonas.tesfaye@aastu.edu.et				
5	Semester and Year offered:	Semester:	I	Year:	5	
6	Credit Hour:	3				
7	Prerequisite/ Co-requisite:	Microprocessors and Interfacing (ECEg4102)				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Explain Embedded systems and critically analyze the design metrics required for a product				
	CLO2	Identify and justify different types of controller and peripheral options in the design of embedded system products.				
	CLO3	Identify and Apply low power computing mechanism in the design of embedded system.				
	CLO4	Identify and apply real time operating systems concept in the design of embedded systems.				
	CLO5	Identify and apply internet of things concept in the design of embedded systems.				
	CLO6	Design and build an embedded system product based on the requirements given.				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√	√			√				
CLO2		√											√	√			√		√		
CLO3					√								√	√	√		√		√		
CLO4					√								√	√	√		√		√		
CLO5				√									√	√	√		√		√		
CLO6			√										√	√	√					√	

	Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box
10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)
	1
	2
	3…etc.
11	Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Introduction 1.4 What is embedded system?	CLO1	1					2	3
1.5 Characteristics, classification, advantages and disadvantages of ES Embedded systems architecture	CLO1	1					2	3
1.6 Embedded systems design and development process	CLO1	1					2	3
1.4 Embedded systems constraints, challenges and optimization of resources	CLO1	1					2	3
Chapter 2: ES Implementation 2.3 Controller alternatives and criteria for choosing ➢ General purpose processors ➢ Application specific instruction set processors (ASIPs) (microcontrollers and DSP controllers) ➢ Programmable hardware (FPGAs) ➢ Application specific integrated circuits (ASIC)	CLO2 CLO6	1	1				2	4
2.4 Peripheral alternatives ➢ Serial communications interfaces (RS232, RS485, I2C, SPI, UART, USB) ➢ Analog to digital and vice versa (ADC/DAC) ➢ Timers (PLL), Real time clock (RTC, Oscillators) capture/compare ➢ Debugging (JTAG, ISP, ICSP)	CLO2 CLO6	2	1				2	5
2.3 Memory management	CLO2 CLO6	1					2	3
Chapter 3: Low power computing 3.6 What motivates low power computing?	CLO3 CLO6	1					2	3
3.7 Importance and challenges of low power computing	CLO3 CLO6	1				√	2	5
3.8 The three approaches of low power computing ➢ Algorithm efficiency ➢ Dynamic power management ➢ Server virtualization	CLO3 CLO6	2	1			√	2	5

	3.9 Low power improvement options ➢ Transistor level improvements ➢ Single component level (RAM, CPU) ➢ System level	CLO3 CLO6	2	1			√	2	5
	3.10 Fundamentals of low power design ➢ System level ➢ Logic level ➢ Technological level	CLO3 CLO6	2	1			√	2	5
	Chapter 4: Real Time Operating Systems (RTOS) 4.1 Over view of operating system (Structure and components)	CLO4 CLO6	1				√	2	3
	4.2 What is an embedded operating system and why we need it?	CLO4 CLO6	1					2	3
	4.3 Similarities and differences of Embedded OS and General purpose OS	CLO4 CLO6	1					2	3
	4.4 Key characteristics and requirements of RTOS	CLO4 CLO6	1					2	3
	4.5 RTOS kernel ➢ Scheduler ➢ Objects ➢ Services	CLO4 CLO6	2	1				2	5
	4.6 Basic functions of RTOS ➢ Task management ➢ Interrupt handling ➢ Memory management ➢ Exception handling ➢ Task synchronization ➢ Task scheduling ➢ Time management	CLO4 CLO6	2	1				2	5
	4.8 Examples of RTOS ➢ RT Linux and its' architecture ➢ Linux Vs RT Linux ➢ Welknown RTOS	CLO4 CLO6	2	1				2	5
	Chapter 5: IoT 5.6 What is an IoT?	CLO5 CLO6	1					2	3
	5.7 Challenges, advantages and disadvantages of IoT	CLO5 CLO6	1					2	3
	5.8 Architecture of IoT	CLO5 CLO6	1					2	3
	5.9 IoT tools and platforms (LoRa, Zygbee)	CLO5 CLO6	2	1				2	5
	5.10 Application of IoT	CLO5 CLO6	1					2	3
	Chapter 6: ES projects 6.5 Elevator	CLO1 - CLO6			3			5	5
	6.6 Traffic Light control	CLO1 - CLO6			3			5	5
	6.7 Motor control (DC, brushless DC, stepper)	CLO1 - CLO6			3			5	5
	6.8 Smart home (remotely control home appliances like room lights, stove, refrigerator, and gate)	CLO1 - CLO6			3			5	5

	6.6 Smart farm (prototype for smart farm from seeding to harvesting)	CLO1 - CLO6			3			5	5
	Total								130

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test	30	2	2	4
2	Assignment	20		10	10
3	Project	50		10	10
4	Choose an item.				
5	Choose an item.				
				Total	14
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		0		6	6
				Grand Total SLT	160

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software's
		2	Project lab, Company Visit
13	Textbook and reference:	1	John B. Peatman, "Design with PIC Microcontrollers" Prentice Hall, 2003, ISBN-10 : 0130462136, ISBN-13 : 978-0130462138
		2	Rajkamal, 'Embedded System – Architecture, Programming, Design', Tata Mc Graw Hill, 2011.
		3	Muhammad Ali Mazidi, Rolin D. McKinlay, and Danny Causey, "The PIC Microcontroller and Embedded systems – Using Assembly and C for PIC18", Prentice Hall, 2007.
		4	Robert Faludi," Building wireless Sensor Networks", O'Reilly, 2011.
		5	Marco Schwartz,"Internet of things with ESP8266", PACKT publishing, 2016.
			Arnold S. Berger: Embedded Systems Design: An Introduction to Processes, Tools and Techniques 1st Edn, ISBN-10 : 1578200733 ISBN-13 : 978-1578200733

2.17.6 Electronics Engineering Focus Area Courses

2.17.6.1 Microelectronic Devices and Circuits

Addis Ababa Science and Technology University					
1	College: Electrical and Mechanical Engineering	Department: Electrical and Computer Engineering			
	Course Name	Microelectronics Devices and Circuits			
	Course Code:	ECEg4610			
3	Synopsis:	This course will help the students think about the design, performance and limitations of microelectronic and nanoelectronics devices including both homo-junction and hetero-junction electronic devices. Innovative new devices and their operation and modeling will be introduced.			
4	Name(s) of Academic Staff:				
5	Semester and Year offered:	Semester:	II	Year:	4
6	Credit Hour:	3			
7	Prerequisite/ Co-requisite:				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Describe semiconductor models to analyze carrier densities and carrier transport			
	CLO2	Apply the basic governing equations to analyses semiconductor devices			
	CLO3	Analyze the inner working of semiconductor p-n diodes, Schottky barrier diodes, ohmic contacts.			
	CLO4	Analyze the inner working of MOSFETs and BJTS, and optimization and modelling of these devices			
	CLO5	Analyze the inner working of new semiconductor devices			

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√																		√		
CLO2		√																			
CLO3		√															√	√	√		
CLO4		√	√														√				
CLO5		√	√														√				

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10 Transferable Skills (if applicable)
(Skills learned in the course of study which can be useful and utilized in other settings)

1	
2	
3…etc.	

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities			Total (SLT)
		Guided learning (F2F)	Guided Learning (NF2F)	Independent Learning (NF2F)	

			L	T	P	O			
	Chapter 1: Semiconductor Fundamentals 1.1 Review of quantum mechanics and Schrödinger equation	CLO1 CLO2	4	6					10
	1.2 Band theory of solids								
	1.3 Carrier transport phenomena,								
	1.4 Recombination and generation								
	Chapter 2: Physics and models related to PN junctions 2.1 PN Junctions	CLO2 CLO3	4	6					10
	2.2 Schottky junctions								
	2.3 Ohmic contacts								
	Chapter 3: MOSFET Design and Modeling 3.1 MOS Capacitance fundamentals, interface and frequency effects,	CLO2 CLO4	8	12					20
	3.2 MOSFET Operation and modeling,								
	3.3 Short and narrow channel effects, Radiation and hot-carrier effects, Breakdown, LDD, NBTI, CMOS latch-up,								
	3.4 CMOS Device design considerations and performance factors,								
	3.5 Brief overview of MOSFET CAD SPICE models- different levels and BSIM series.								
	Chapter 4: Bipolar Junction transistors 4.1 Bipolar device Design and Modeling,	CLO2 CLO4	8	12					20
	4.2 Small and large signal models, Non-ideal effects, breakdown voltage, charge storage,								
	4.3 Bipolar Device optimization and performance factors for digital and analog circuits,								
	4.4 Brief overview of BJT CAD SPICE model and VBIC model introduction.								
	Chapter 5: Modern Nano electronics Devices 5.1 Poly silicon emitter transistors, Heterojunctions, 2D electron gas, band alignment, SiGe HBTs, SOI MOSFETs, Floating body effect, Source/drain	CLO2 CLO5	6	9					15

	engineering,								
	5.2 Brief introduction to HEMTs, MESFETs and MODFETs. Steep subthreshold transistors – TFETs, IMOS etc.,								
	Total		30	45					75

Assessment				
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Assignments	20%			
2	Tests	25%			
3	Quiz	5%			
				Total	

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50%			
			Grand Total SLT	

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course (e.g., Software, computer lab, simulation room …etc.)	1	Software
		2	Computer Lab
		3	Laboratories
13	Textbook and reference:	1	Donald A. Neaman, Semiconductor Physics and Devices, Tata McGraw-Hill, 2014

2.17.6.2 Analog System Design

Addis Ababa Science and Technology University						
1	College: Electrical and Mechanical Engineering			Department: Electrical Engineering		
	Course Name	Analog System Design				
	Course Code:	ECEg5606				
3	Synopsis:					
4	Name(s) of Academic Staff:					
5	Semester and Year offered:	Semester:	II	Year:	4	
6	Credit Hour:	3				
7	Prerequisite	Applied Electronics II (ECEg3102)				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Understand the basic design principles analog systems				
	CLO2	Determine frequency response, stability and compensation of CMOS				
	CLO3	Understand the behavior and characteristics of Non-linear circuits				
	CLO4	Understand the design and working principles of VCO, current mirrors and repeaters				
	CLO5	Design and Implementation of ADC and DAC				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√					√			
CLO2		√											√	√			√		√		
CLO3			√										√	√			√		√	√	
CLO4				√									√	√					√	√	
CLO5					√								√	√					√	√	

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)
1	Practical design of data converters
2	Design of data converters using software

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Introduction 1.1 Introduction to Analog systems	1	√					√	8 hrs.
1.2 Analog system vs Digital systems								
1.3 Applications of analog and digital systems								
1.4 Basic design principles of analog systems								

	Chapter 2: operational Amplifier Fundamentals 2.1 Ideal vs real op-amp characteristics	2	√	√				√	12 hrs.
	2.2 Types of Op-amp								
	2.3 MOS amplifiers 2.3.1 frequency Response 2.3.2 Stability and Compensation								
	2.4 Applications of Op-amp								
	Chapter 3: Non-Linear Circuit 3.1 Voltage Comparators and its applications	3	√	√		√	√	√	12 hrs.
	3.2 Schmitt Triggers								
	3.3 Precision Rectifiers								
	3.4 Analog switches								
	3.5 Peak Detectors								
	3.6 Sample and Hold Amplifiers								
	Chapter 4: Controlled Oscillators 4.1 PLL	4	√	√		√	√	√	8 hrs.
	4.2 Current Mirror								
	4.3 Repeaters								
	Chapter 5: A-D and D-A Converters 5.1 A-D conversion Techniques	5	√	√		√	√	√	20 hrs.
	5.2 D-A Conversion Techniques								
	5.3 A-D and D-A design methods								
	5.4 Modulators and Demodulators								
	5.5 Applications of A-D and D-A converters								
	Total								60 hrs.

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quize	5%	√		30’
2	Assignments	20%	√	√	15 hrs.
3	Tests	15%	√		1 hr.
4	Project	15%	√	√	
				Total	

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50%	√		3 hrs.
			Grand Total SLT	

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO’s numbering in item 9.

12	Special requirements and resources to deliver the course	1	Simulation Room
		2	Computer Lab

		3	Software
13	Textbook and reference:	1	Behazad Razavi, Design of analog CMOS Integrated circuits, 2nd Ed, McGraw-Hill, 2017.
		2	Philip e. Allen and R. Holberg, CMOS Analog circuit design, 3rd Ed, oxford university press, 2012.
		3	Analog Circuit Design techniques at 0.5 v, Springer science Business Media, LLA chatterjee
		4	Lecture slides and class notes

2.17.6.3 Digital Systems Design

	Addis Ababa Science and Technology University	
1	**College**: Electrical and Mechanical Engineering	**Department: Electrical Engineering**
	Module Name	Digital Systems Design
	Course Code:	ECEg5602
3	Synopsis:	Digital System Design focuses on the process of designing or developing system. This course begins with the basic review of the digital logic design and then the implementation of hardware versus software is discussed. The course focuses around the behavioral modeling, FSM and sequential logic elements in VHDL. For lab exercises, the students must use ModelSim software, it helps to implement significant projects of the course. Digital synchronous system design and the introductory of high-speed digital system design is also briefly discussed.
4	Name(s) of Academic Staff:	
5	Semester and Year	Semester: II; Year: 5
6	Credit Hour:	4
7	Prerequisite	Digital Logic Design (ECEg3104)
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Construct the concept of digital system design.
	CLO2	Develop the concept of digital logic design to the system design.
	CLO3	Connect and model logic design using VHDL.
	CLO4	Design systems using sequential logic elements and FSM.
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1		√											√				√				
CLO2		√											√				√				
CLO3			√										√	√	√			√	√		√
CLO4			√										√		√				√	√	√

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		GL (F2F)				GL (NF2F)	IL (NF2F)	
		L	T	P	O			
Chapter 1: INTRODUCTION a. Introduction b. Review Logic Minimizations c. Combinational Logics d. Sequential Logics	CLO1 CLO2	√						6
Chapter 2: VHDL 2.1 Hardware versus Software Implementations 2.2 Describing Hardware in VHDL 2.3 VHDL Timing Model 2.4 Practice on ModelSim	CLO3	√	√	√				7

	Chapter 3: BEHAVIORAL MODELING 3.1 The Process Body 3.2 Variable in a Process 3.3 Data Types and Loop Constructs 3.4 Practice on ModelSim in VHDL	CLO2 CLO3	√	√	√				7
	Chapter 4: MODELING SEQUENTIAL MACHINE 4.1 Sequential Logic Elements 4.2 Finite- State Machines (FSM) • Mealy State Machine • Moore State Machine	CLO4	√	√	√				10.5
	Chapter 5: DIGITAL SYNCHRONOUS SYSTEM DESIGN 5.1 Principles of Timing in Synchronous System 5.2 Reading Input Data Values 5.3 Implementing Pattern Recognizer 5.4 Designing a System Comprising a Datapath and Controller	CLO1 CLO4	√		√				7
	Chapter 6: HIGH SPEED DIGITAL SYSTEM DESIGN 6.1 Introduction 6.2 Design Optimization	CLO1	√						6
								Total	43.5

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Test-I	10	√		13
2	Test-II	10	√		17.5
3	Quiz	5	√		7
4	Assignment-I	10		√	20
5	Assignment-II	15		√	23.5
				Total	**43.5**
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	√		43.5
				Grand Total SLT	**43.5**

12	Resource required	1	Software - ModelSim
		2	Computer Lab
13	Textbook	1	Mark Zwolinskl , Digital System Design with VHDL, 2nd Ed, Pearson, 2003.
		2	Volnei A. Pedroni, Circuit Design with VHDL, 3rd Ed, MIT Press, 2020

2.17.6.4 IC Technology

	Addis Ababa Science and Technology University	
1	College: Electrical and Mechanical Engineering	Department: Electrical and Computer Engineering
	Course Name	IC Technology
	Course Code:	ECEg5604
3	Synopsis:	This course will introduce the student to the world of semiconductor IC technology fabrication. Emphasis will be laid on covering the basics of all key process-flow steps in advanced CMOS fabrication. The course will also provide a comprehensive flavor of advanced device fabrication techniques, trade-offs and key considerations/constraints in developing a device/circuit process flow.
4	Name(s) of Academic Staff:	
5	Semester and Year offered:	Semester: II; Year: 5
6	Credit Hour:	3
7	Prerequisite	Nil
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Explain how a silicon wafer is fabricated and turned into an operating integrated circuit (IC)
	CLO2	Understand manufacturing methods and their underlying scientific principles in the context of technologies used in IC chip fabrication
	CLO3	Relate device characteristics to key process parameters
	CLO4	Design and outline the process flow, times, species, and temperatures for a practical circuit
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√																	√	√		
CLO2		√															√				
CLO3		√																	√		
CLO4				√													√		√		

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F) L	T	P	O	Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT)
Chapter 1: Introduction 1.1 Historical Perspective and technology trends; 1.2 CMOS process flow starting from substrate selection to multilevel metal formation	CLO1 CLO4	2	3					5
Chapter 2: Crystal Growth and Wafer Basics 2.1 Crystal structure 2.2 Czochralski and FZ growth methods, wafer preparation	CLO2 CLO3	2	3					5

	and specifications.								
	Chapter 3: Clean rooms and wafer cleaning 3.1 Basic concepts, manufacturing methods and equipment, measurement methods	CLO2 CLO3	2	3					5
	Chapter 4: Photolithography 4.1 Light sources, wafer exposure systems, photoresists, baking and development	CLO2 CLO3	4	6					10
	4.2 Mask making, measurement of mask features and defects, resist patterns and etched features.								
	Chapter 5: Oxidation 5.1 Oxide growth kinetics and models,	CLO2 CLO3 CLO4	4	6					10
	5.2 Wet and dry oxidation								
	5.3 Defects, measurement methods and characterization.								
	Chapter 6: Diffusion and Ion-implantation 6.1 Models for diffused layers, characterization methods, segregation, interfacial dopant pileup, oxidation enhanced diffusion, dopant-defect interaction	CLO2 CLO3 CLO4	6	9					15
	6.2 Ion-implantation Basic concepts, high energy and ultralow energy implantation, shallow junction formation and modeling, electronic stopping, damage production and annealing, RTA process and dopant activation								
	Chapter 7: Thin film deposition 7.1 Chemical and physical vapor deposition	CO2 CO3 CO4	4	6					10
	7.2 epitaxial growth, manufacturing methods and systems								
	7.3 deposition of dielectrics and metals commonly used in VLSI								
	Chapter 8: Etching and Back-end Technologies 8.1 Etching technologies: Wet etching, plasma etching, RIE, etching of materials used in VLSI, modeling of etching	CO2 CO3 CO4	4	6					10
	8.2 Back-end technology: Contacts, vias, multi-level interconnects, silicided gates								

	and S/D regions, reflow and planarization, multi-chip modules and packaging.								
	Total		28	42					70

Assessment				
Continuous Assessment	Percentage Total-50(%)	F2F	NF2F	SLT
1 Assignments	20%			
2 Tests	25%			
3 Quiz	5%			
			Total	
Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50%			
			Grand Total SLT	

	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.		
13	Textbook and reference:	1	Plummer, Deal, Griffin, Silicon VLSI Technology: Fundamentals, Practice, and Modeling, 1, Prentice Hall, 2000.

2.17.6.5 Optoelectronics

	Addis Ababa Science and Technology University	
1	College: Electrical and Mechanical Engineering	Department: Electrical and Computer Engineering
	Module Name	Optoelectronics
	Course Code:	ECEg5609
3	Synopsis:	This course provides a complete overview of the wide variety of different semiconductor optoelectronic devices employed in light wave systems and networks. Introduction to the physical principles upon which the laser and number of other optoelectronic devices are based. Different types of laser, second harmonic generation using lasers, modulators (both electro-opto and acousto-optic) and photodetectors such as the photodiode, avalanche photodiode and photomultiplier. Properties of optical fibers and the likely requirements of an optical communication system.
4	Name(s) of Academic Staff:	
5	Semester and Year offered:	Semester: I Year: 5
6	Credit Hour:	4
7	Prerequisite/ Co-requisite:	Applied Electronics II (ECEg3102)
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Demonstrate a mastery of basic mechanisms of light generation (including LED and lasers) through detailed understanding and analysis of operation principles, characteristics, design architectures and trade-offs of semiconductor light emitting diodes and lasers.
	CLO2	Understand and compare operation principles, characteristics, design architectures and trade-offs of optical detectors and modulators of light.
	CLO3	Understand basic system design of fiber optic communication link and fundamental theory of fiber optics.
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignm ent	Project	Lab-report
CLO1	√		√	√													√		√		
CLO2			√	√													√	√	√		
CLO3				√													√	√	√		

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F) L	T	P	O	Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT)
Chapter 1: Review of Basic Semiconductor Physics 1.1 Introduction to quantum physics	CLO1	6	9					15
1.2 Energy bands in solids, the E-K diagram, density of states, occupation probability, pn junction, homojunction and heterojunction semiconductors								
1.3 Interaction of Photons with Electrons and Holes in Semiconductor: rates of emission and absorption, stimulated emission								
Chapter 2: Light Emitting Diodes (LEDs) 2.1 LED structures	CLO1	4	6					10

	2.2 LED characteristics								
	Chapter 3: Lasers 3.1 Operating principles, types of lasers, modes of operation	CLO1	6	9					15
	3.2 Laser Diodes: Structures and properties								
	Chapter 4: Photodetector 4.1 PIN photodiodes	CLO2	6	9					15
	4.2 Avalanche photodiodes								
	Chapter 5: Optoelectronic Modulation and Switching Devices 5.1 Electro-optics, acousto-optics, liquid crystals	CLO2 CLO3	6	9					15
	5.2 Optoelectronic modulation applications								
	Total		28	42					70

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Assignments	20%			
2	Tests	25%			
3	Quiz	5%			
				Total	
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50%			
				Grand Total SLT	

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

13	Textbook and reference:	1	S. O. Kasap, "Optoelectronics and Photonics: Principles and Practices," 2nd Ed, Pearson, 2012.
		2	K. Dutta, Xiang Zhang, Optoelectronic Devices, World Scientific Publishing, 2018.

2.17.6.6 Power Electronics

Addis Ababa Science and Technology University						
1	College: Electrical and Mechanical Engineering			Department: Electrical and Computer Engineering		
2	Course Category	Stream (focus Area) course		Course Code: ECEg5608		
	Course Name	Power Electronics				
3	Synopsis:	Fundamentals of power electronics device and converters, Power converters to supply electric drives				
4	Name(s) of Academic Staff:	Wondwosen Wubu				
5	Semester and Year offered:	Semester:	I	Year:	5	
6	Credit Hour:	3				
7	Prerequisite/ Co-requisite:	Applied Electronics II (ECEg3102)				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Draw characteristics of different power electronic switching devices				
	CLO2	Explain stable steady-state operation and transient dynamics of a motor-load system				
	CLO3	Apply Power Electronics converter in Motor drive Application.				
	CLO4.	Design and Analyze the performance of AC to DC, DC to DC, AC to AC Converters and DC to AC inverters				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignme	Project	Lab-report
CLO1	√																√	√			√
CLO2	√																√			√	√
CLO3		√																	√	√	√
CLO4			√														√		√	√	√

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
1	Distribution of Student Learning Time (SLT)	

1	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	Chapter 1: power electronic switching devices. 1.1. introduction 1.2. Power Diode 1.3. Power Bipolar Transistors 1.4.Insulated Gate Bipolar Transistor 1.5. Thyristors	**1**	**4**	**6**	**3**			**7**	**23** hours
	Chapter 2: AC to DC converters 2.1 Single-Phase converter 2.2 Three-Phase Converter 2.3 Pulse-Width-Modulation Control	1,4	**4**	**6**	**3**			**9**	**22 hours**
	Chapter 3: DC-DC Converters 3.1 Performance Parameters of DC–DC Converters 3.2 Step-Down Converter 3.3 Step-Up Converter 3.4 Converter Classification 3.5 Switching-Mode Regulators 3.5.1 Buck Regulators 3.5.2 Boost Regulators 3.5.3. Buck–Boost Regulators	**1,4**	**4**	**4**	**3**			**6**	**17 hours**
	Chapter 4: DC –AC Converters (Inverters) 4.1Single-Phase Voltage Source Inverters 4.2 Three-Phase Voltage Source Inverters 4.3 Voltage Control of Single-Phase Inverters 4.4 Voltage Control of three-Phase Inverters	**1,4**	**4**	**6**	**3**			**9**	**22hours**

	Chapter 5: AC Voltage Controllers 5.1 Performance Parameters of AC Voltage Controllers 5.2 Single-Phase Full-Wave Controllers 5.3 Three-Phase Full-Wave Controllers 5.4 Cycloconverters 5.5 AC Voltage Controllers with PWM Control	**1,4**	**4**	**6**	**3**			**9**	**22 hours**
	Total		24	34	21			50	132

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	15	2	3	5 hours
2	Project	10	1	3	4 hours
3	Lab-report	10		4	4 hours
4	Assignments	10		4	4 hours
5	Quiz	5	1		1 hour
				Total	**18 hours**
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	3	7	**10 hours**
				Grand Total SLT	**160 hours**

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face

Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Simulation Room
		2	Software
		3	Computer Lab
		4	Workshop
13	Textbook and reference:	1	POWER ELECTRONICS circuit devices and application, MUHAMMAD H. RASHID,4th edition,2014
		2	Power Electronics: Converters, Applications, and Design, 3rd Edition,2003
		3	Advanced Power Electronics Converters: PWM Converters Processing AC Voltages,2014

2.17.7 Power Engineering Focus Area Courses

2.17.7.1 Power Systems II

Addis Ababa Science and Technology University		
1	College: Electrical and Mechanical Engineering	Department: Electrical Engineering
2	Name of Course:	Power System II — Course Category: Core
	Course Code:	ECEg4708
3	Synopsis:	- To learn load flow study, analytical techniques of fault analysis and stability analysis. To provide comprehensive coverage of load flow studies - To Analyze power system transients and HVDC transmission This course helps students to develop the knowledge of computing the power/load flow in electrical power systems such as voltage magnitude, phase, active reactive power, losses etc The students will learn and understand the analytical techniques of fault analysis which has a great role in designing, selecting the electrical equipment and protection. Students also can get very important knowledge on analyzing power system stability and transient in this course to which they can know system stability under uncertain conditions and know how ,when system will stable. This course also proved to students to learn and analyze HVDC transmission.
4	Name(s) of Academic Staff:	Fekade Walle
5	Semester and Year offered:	Semester: II — Year: 4
6	Credit Hour:	4
7	Prerequisite	Power system I
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:	
	CLO1	Identify power system network model formulation and Know formation of Y_{bus} matrix, Load flow solutions using Gaus Seidal, Newton Raphson, and other methods
	CLO2	Analyzes power system faults, Power System transients, Power system stability and compute using hand calculation and power world, Etap, digsilent software
	CLO3	Design standard/selected electric power system having more bus bars using power system software and find load flow parameters, do fault analysis, stability analysis and transient analysis
	CLO4	Work collaboratively on a team to successfully complete the design project.
9	Mapping of the Course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:	

Course Learning Outcomes (CLO)	Program Learning Outcomes (PLO)												Teaching Methods				Assessment				
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√												√				√				
CLO2					√								√	√	√		√		√		√
CLO3			√										√	√	√			√	√		√
CLO4									√						√					√	

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)
1	Programming and simulating skills
2	Group working skills
3	Mathematical modeling and design skills

11	Distribution of Student Learning Time (SLT)			
	Course Content Outline	CLO	Teaching and Learning Activities	Total (SLT)

			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			
	Chapter 1: Load flow studies: 1.1 Network model formulation. Formation of Y_{bus} matrix Load flow problem Load flow solutions using Gaus Seidal and Newton Raphson	1	8	12	4			3	27Hrs
	Chapter 2 : Fault analysis: Introduction to fault Symmetrical 3-phase faults Symmetrical components. Unsymmetrical faults	1	8	9	4				21Hrs
	Chapter 3: Power System transients: Surge phenomenon. Propagation of surges (travelling waves); Reflection and refraction of waves; Attenuation of traveling waves; Determination of system voltage produced by traveling waves; Generation of switching over-voltages on transmission lines	2,3	6	9	4			2	21Hrs
	Chapter 4: Power system stability: Swing equation; Power angle equation; Steady-state stability analysis; Transient stability analysis; Stability and stability limit Swing equation; Power angle equation; Steady-state stability analysis; Transient stability analysis; Stability and stability limit Numerical solution of swing equation. Design the power system having standard bus bar	2,4	10	16	2			2	30Hrs
	Chapter 5: HVDC transmission : Principle of AC/DC conversion, Economic considerations; Applications of HVDC; Advantages and disadvantages of HVDC systems. Basic Principle of AC/DC conversion, Advantages and disadvantages of HVDC HVDC system configuration; Applications of HVDC; HVDC Converter Station Equipment; Reactive power demand; HVDC control system HVDC stability limit ;	9+3	8	12	2			3	25 Hrs
	Total		42	58	16	0	0	10	126Hrs
	Assessment								

	Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT	
	1	Tests	20%	3	6	9Hrs	
	2	Quiz	5%	1	0	1Hrs	
	3	Project	15%	6	9	15Hrs	
	4	Lab-report	10%	2	7	9Hrs	
	Total						34Hrs
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT	
	Final Exam		50%	3	10	13Hrs	
	Grand Total SLT						160Hrs
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non-Face to Face						

12	Special requirements and resources to deliver the course	1	Software: MATLAB/Simulink, power world ,Etap,Digsilen
		2	Computer Lab
		3	Industry Visit : Transmission Network and Dispatch Centers
13	Textbooks and references:		1.By J. Duncan Glover, Thomas Overbye, Mulukutla S. Sarma ,Power System Analysis and Design , 6th edition, 2017 2. Allen J. Wood and B.F. Wollenberg, Power Generation, Operation and Control, 2nd Edn, John Wiley, 1997. 3. P. Kundur, Power system Operation and Control, Tata Mc-grah Hill Edition, 2006. 4. Syed Nasar, Electrical Power Systems (Schaum's Outline Series), McGraw-hill Publishing Company, 2004. 5. D P Kothari, I J Nagrath, Power System Engineering,2019 6. Jan Machowski, Janusz Bialek, James Richard,Power System Dynamics and Stability, 1997 7. Turan Gonen ,Modern Power System Analysis, second edition, 2013

2.17.7.2 Power Systems Automation

Addis Ababa Science and Technology University						
1	College: Electrical and Mechanical Engineering			Department: Electrical and Computer Engineering		
2	Name of Course:	Power Systems Automation				
	Course Code:	ECEg4706				
3	Synopsis:	A review and analysis of relay logic and programmable logic controllers; Programming, installation and troubleshoot PLC modules; Analyze power system networking protocols, power system automation, Design electric power systems using SCADA.				
4	Name of Academic Staff:	Fekade Walle				
5	Semester and Year offered:	Semester:	II	Year:	4	
6	Credit Hour:	4 (Lec 2hrs; Tut 3hrs; Lab 3hrs)				
7	Co-requisite	Power System II (ECEg4708)				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to:					
	CLO1	Understand industrial, electric power system automation problems: the necessity of programmable logic controller over relay logic controllers, and remote terminal unit.				
	CLO2	Program and troubleshoot PLC modules both with analog and digital devices.				
	CLO3	Analyze data communication, protocols, field devices and computer networking, and their application for power system automation.				
	CLO4	Apply SCADA systems for power system automation problems.				
9	Mapping of the Course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes (CLO)	Program Learning Outcomes (PLO)																					
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	Teaching Methods				Assessment				
													L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1						√											√				
CLO2					√														√		√
CLO3		√															√	√			
CLO4					√															√	√

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Programming skills
	2	Group working skills

11	Distribution of Student Learning Time (SLT)								
	Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			

	Chapter 1: Introduction to Automation Industrial revolutions: 1st, 2nd, 3rd, 4th, 5th Introduction to Relay control system What is relay How relay logic Works Relay Logic Circuits Control panel: Choosing between Relay Logic control and PLC	1	4	6					10Hrs
	Chapter 2: Programmable Logic Controller PLC components PLC Programming Languages Ladder Diagram (LAD) Programming Elements of Ladder Diagram PLC Digital Programming Timers/Counters PLC Analog Programming Conversion Operation PLC Compare Instruction Human Machine Interface (HMI) Programming PLC with actuators: Electric, Pneumatic and Hydraulic actuators PLC and Actuators Wiring Troubleshooting of PLC system	2,3	8	10	9			3	30Hrs
	Chapter 3 : Introduction to Data Communications and Computer Networking Overview Types of computer networks Network LAN technologies Computer network topologies Computer network model Digital and Analog transmission Transmission media Wireless transmission, Multiplexing, Switching Transmission control protocols	3	12	6	2			4	24Hrs
	Chapter 4: SCADA Systems Basics of SCADA systems Essential components of the SCADA SCADA Architectures Communication Protocols of automation systems (SCADA,DCS,..etc) Programming SCADA Systems Security and vulnerability of SCADA	1,4,2,3	8	9	12			2	31Hrs
	Chapter 5 : Power System Automation 5.1 Introduction to Power System Automation State And Trend of Generation Automation Generation Automation Monitoring and Control Types of Substations, Substation Components	1,2,3,4	8	10	12				30Hrs

	Intelligent Substation Monitoring And Control Substation Automation For Energy Management Application of SCADA in power system Automation								
	Total		40	41	35			9	125Hrs

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	20%	3	4	7Hrs
2	Quiz	10%	2	0	2Hrs
3	Project	20%	6	10	16Hrs
				Total	25Hrs

Final Exam	Percentage 50 (%)	F2F	NF2F	SLT
Final Exam	50%	3	7	10Hrs
			Grand Total SLT	160Hrs

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non-Face to Face

12	Special requirements and resources to deliver the course	1	Software:	Siemens Step 7 V13, WinCC, SCADA software,
		2	Computer Lab	
		3	Industry Visit	Power system automation industries
13	Textbooks and references:	1.Introduction to PLC programming and Implementation: from Relay logic to PLC logic, Industrial Text and Video Company 1-800-752-8398 2.Mohammad Shahidehpour, Yaoyu Wang, Communication and Control in Electric Power Systems: Applications of Parallel and Distributed Processing, Wiley-IEEE Press, 2003. 3.Dr.M.K Khedkar Electrical Power Distribution automation,2010 4.J. Duncan Glover Mulukutla Sarma : Power System Analysis and Design, SI Version,2012. 5.Stanley H. Horowitz, Arun G. Phadke , Power System Relaying, third edition,2008 6. Rajesh Mehra, PLCs and SCADA : Theory and Practice,2011 K S Manoj, Industrial Automation with SCADA: Concepts, Communications and Security,2019		

2.17.7.3 Electrical Machines II

Addis Ababa Science and Technology University			
1	College: Electrical and Mechanical Engineering		Department: Electrical and Computer Engineering
2	Module Category	Core Elective/focused Area Module	Module Code:
	Module Name		
	Course Code:	ECEg4222	
3	Synopsis:	This course includes working principles, performance characteristics and design aspects of various types of electric machines.	
4	Name(s) of Academic Staff:	Mengistu Assefa	
5	Semester and Year offered:	Semester: II	Year: 4
6	Credit Hour:	4	
7	Prerequisite/ Co-requisite: (if any)	ECEg3132; **Electrical Machine-I**	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Enhance and understand advanced theory, to analyze power requirements, power capability, Efficiency and operating characteristics of electrical Machine	
	CLO2	Identify, Formulate, and solve problems related to electrical machines	
	CLO3	An ability to conduct experiments, as well as to analyze and interpret data of electrical machine.	
	CLO4.	Explain the design consideration for rotating and static electrical machines with particular reference to magnetic circuit and thermal rating of the machines	
	CLO5.	**To impart knowledge on Construction, principle of operation and performance of single-phase motors**	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√	√		√									√	√	√		√		√		√
CLO2	√	√		√	√								√	√			√	√	√		√
CLO3			√	√	√								√	√	√			√	√		√
CLO4			√		√								√	√							
CLO5		√		√	√								√	√	√		√	√	√		√

	Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box	
10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Capability to perform various tests on different electrical machines safely.
	2	Ability to compare theoretical expressions with experimental results and to resolve any apparent differences
.11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Electromechanical energy conversion principles 1.4. introduction 1.5. Singly excited magnetic systems 1.6. Doubly excited magnetic system	1,2,3	4	2			1.5	6	13.5
Chapter 2: Transformers 2.1 Concept of inrush current and Harmonics on transformer. 2.2 Parallel operation of transformers 2.3 Design aspects 2.4 Special type transformers	1,2,3	**7**	1	2		2	9	21
Chapter 3: Induction machines 3.1 Introduction to Three-phase IM windings & winding factors 3.2 Induction Motor Circle diagram 3.3 Design aspects	1,2	7	2	3		2.5	**7**	21.5
Chapter 4: DC Machines	1,2							

	4.1 DC machine windings 4.2 Dynamic equation of dc machines 4.3 DC machines Control aspects		**6**	**2**				**6**	**14**
	Chapter 5: Synchronous machines 5.1 Introduction 5.2 Determination of circuit parameters of salient pole SM 5.3 Operating characteristics and stability of SM 5.4 Two reaction theory 5.5 Transients in synchronous machine 5.6 Paralleling of SGs	1,2,3	**11**	**6**	**5**			**12**	**25**
	Chapter 6: Fractional horse-power motors 6.1 Constructional features, operating principles and double revolving field theory 6.2 Equivalent circuit and performance characteristics 6.3 Types of single-phase motor. 6.4 Starting methods of single-phase motor	1,2,3	8	1	5		2	8	24
	Total		42	14	15		12.5	49	132.5

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	15	✓		3hours
2	Project	10		✓	3 hours
3	Lab-report	10		✓	6 hours
4	Assignments	10		✓	5 hours
5	Quize	5	✓		1 hour

					Total	**18 hours**
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50	✓		**3 hours**
					Grand Total SLT	**153.5 hours**
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					
12	Special requirements and resources to deliver the course (e.g. software, computer lab, simulation room …etc.)	1	Machine lab			
		2	Choose an item.			
13	Text book and reference: (note: ensure the latest edition /publication)	1	***Textbook:*** 1. Dr. P.S. Bimbhra : Electrical Machinery			
		2	J. Hindmarsh: Electrical Machines and their Applications			
		3	Kosow: Electric Machinery and Control, Prentice-Hall			
		4	Siskind: Electrical Machines, McGraw-Hill			
		5	A.Monti, F. Ponci: Electric machine theory through FEM analysis,			

2.17.7.4 Power Electronics and Electric Drives

Addis Ababa Science and Technology University					
1	College: Electrical and Mechanical Engineering		Department: Electrical and Computer Engineering		
2	Course Category	Stream (focus Area) course	Course Code: ECEg5701		
	Course Name	Power Electronics and Electric drives			
3	Synopsis:	Fundamentals of power electronics device and converters, Dynamic behavior of electric drives Power converters to supply electric drives			
4	Name(s) of Academic Staff:	Wondwosen Wubu			
5	Semester and Year offered:	Semester:	I	Year:	5
6	Credit Hour:	4			
7	Prerequisite/ Co-requisite:	Electrical Machines II (ECEg4704)			
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:				
	CLO1	Draw characteristics of different power electronic switching devices			
	CLO2	Explain stable steady-state operation and transient dynamics of a motor-load system			
	CLO3	Apply Power Electronics converter in Motor drive Application.			
	CLO4.	Design and Analyze the performance of AC to DC, DC to DC, AC to AC Converters and DC to AC inverters			
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:				

Course Learning Outcomes (CLO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Teaching Methods L	T	P	O	Assessment: Test	Quiz	Assignment	Project	Lab-report
CLO1	√																√	√			√
CLO2	√																√			√	√
CLO3		√																	√	√	√
CLO4			√														√		√	√	√

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities: Guided learning (F2F) L	T	P	O	Guided Learning (NF2F)	Independent Learning (NF2F)	Total (SLT)
Chapter 1: power electronic switching devices. 1.7. introduction 1.8. Power Diode 1.9. Power Bipolar Transistors 1.4.Insulated Gate Bipolar Transistor 1.6. Thyristors	**1**	**4**	**6**	**3**			**7**	**23** hours

	Chapter 2: AC to DC converters 2.1 Single-Phase converter 2.2 Three-Phase Converter 2.3 Pulse-Width-Modulation Control	1,4	**4**	**6**	**3**			**9**	**22 hours**
	Chapter 3: DC-DC Converters 3.1 Performance Parameters of DC–DC Converters 3.2 Step-Down Converter 3.3 Step-Up Converter 3.4 Converter Classification 3.5 Switching-Mode Regulators 3.5.1 Buck Regulators 3.5.2 Boost Regulators 3.5.3. Buck–Boost Regulators	**1,4**	**4**	**4**	**3**			**6**	**17 hours**
	Chapter 4: DC –AC Converters (Inverters) 4.1Single-Phase Voltage Source Inverters 4.2 Three-Phase Voltage Source Inverters 4.3 Voltage Control of Single-Phase Inverters 4.4 Voltage Control of three-Phase Inverters	**1,4**	**4**	**6**	**3**			**9**	**22hours**
	Chapter 5: AC Voltage Controllers 5.1 Performance Parameters of AC Voltage Controllers 5.2 Single-Phase Full-Wave Controllers 5.3 Three-Phase Full-Wave Controllers 5.4 Cycloconverters 5.5 AC Voltage Controllers with PWM Control	**1,4**	**4**	**6**	**3**			**9**	**22 hours**
	Chapter 6: DC Drives 6.1 Introduction 6.2 Single phase drives. 6.3 Three phase drives	**2,3**	**2**	**3**	**3**			**5**	**13 hours**
	6.4 Dc- Dc Converter Drives								
	Chapter 7: AC Drives 7.1 Introduction 7.2 Induction motor Drives 7.3Synchrnous motor drives 7.4 Stepper motor Drives	**2,3**	**2**	**3**	**3**			**5**	**13 hours**
	Total		24	34	21			50	132

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	15	2	3	5 hours
2	Project	10	1	3	4 hours
3	Lab-report	10		4	4 hours
4	Assignments	10		4	4 hours
5	Quiz	5	1		1 hour

<table>
<tr><td rowspan="4"></td><td colspan="5" align="right">Total</td><td>18 hours</td></tr>
<tr><td colspan="2">Final Exam</td><td>Percentage 50 (%)</td><td>F2F</td><td>NF2F</td><td>SLT</td></tr>
<tr><td colspan="2">Final Exam</td><td>50</td><td>3</td><td>7</td><td>10 hours</td></tr>
<tr><td colspan="5" align="right">Grand Total SLT</td><td>160 hours</td></tr>
<tr><td></td><td colspan="6">L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO’s numbering in item 9.</td></tr>
<tr><td rowspan="4">12</td><td rowspan="4">Special requirements and resources to deliver the course</td><td>1</td><td colspan="4">Simulation Room</td></tr>
<tr><td>2</td><td colspan="4">Software</td></tr>
<tr><td>3</td><td colspan="4">Computer Lab</td></tr>
<tr><td>4</td><td colspan="4">Workshop</td></tr>
<tr><td rowspan="3">13</td><td rowspan="3">Textbook and reference:</td><td>1</td><td colspan="4">POWER ELECTRONICS circuit devices and application, MUHAMMAD H. RASHID,4th edition,2014</td></tr>
<tr><td>2</td><td colspan="4">Power Electronics: Converters, Applications, and Design, 3rd Edition,2003</td></tr>
<tr><td>3</td><td colspan="4">Advanced Power Electronics Converters: PWM Converters Processing AC Voltages,2014</td></tr>
</table>

2.17.7.5 Electrical Installation

Addis Ababa Science and Technology University			
1	College: College of Electrical and Mechanical Eng.		Department: Electrical and Computer Engineering
2	Module Category	Core course	Course Code: ECEg5705
	Course Name	Electrical Installation	
3	Synopsis:	In this course we discuss about: Illumination Science, Electrical regulation and standards, Electrical installation materials, components and accessories, Residential installation design, Commercial (Industrial) installation design, Earthing, grounding system, testing of electrical installation, Electrical installation contracting and Cost estimation, Contract document preparation.	
4	Name(s) of Academic Staff:	Shegaw Firew	
5	Semester and Year offered:	Semester: I	Year: V
6	Credit Hour:	3 (2 hrs Lec, 3 hrs Lab)	
7	Prerequisite/ Co-requisite:	Electrical Workshop Practices I (ECEg3113)	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Read, implement electrical installation and construct electrical installation drawings.	
	CLO2	Identify and use different electrical installation materials, components and accessories.	
	CLO3	Apply electrical regulations and standards for consumer premises wiring design and construction.	
	CLO4	Apply the science and art of internal and external illumination of buildings.	
	CLO5	Design Residential and Commercial Electrical installation.	
	CLO6	Estimate electrical installation cost and Contracting electrical construction.	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)											Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1						√						√	√	√		√		√		√
CLO2		√										√	√	√			√			√
CLO3												√	√	√			√			√
CLO4												√	√			√				
CLO5			√									√	√	√						√
CLO6		√										√	√	√				√		√

Indicate the relevancy between the CLO and PO by ticking "√" on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Read, implement electrical installation and construct electrical installation drawings.
	2	Select and use different electrical installation materials, components and accessories.
	3	Apply the science and art of internal and external illumination of buildings.
	4	Perform electrical regulations and standards for consumer premises wiring design and construction.
	5	Design Residential and Commercial Electrical installation
	6	Estimate electrical installation cost and prepare contract documentation
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities	Total (SLT) In hrs.

			Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
			L	T	P	O			120 hrs.
	1. Chapter 1: **Illumination** 1.1.Lighting 1.2. lighting terminologies and law 1.3.Artificial light source and their types 1.4.Lighting schemes and their types 1.5.Illumination design and calculation	2,4	13 hrs	3 hrs				10 hrs	
	Chapter 2: **Electrical installation in consumer premises** 2.1. Electrical installation materials, components and accessories 2.2. Electrical regulation and standards 2.3. Commercial (Industrial) installation design; Residential and Commercial installation design - Lighting design - Power socket design - Distribution and control board sizing and design - Power Feeder line design - Fire Alarm design - Security camera design - Access control design - Off grid solar system design - Lightening Arrestor design	2,3,5	19 hrs	7 hrs				6 hrs	32 hrs
	Chapter 3: **Grounding system and Testing Installation** 3.1. Earthing and method of earthing 3.2. Grounding system 3.3. Earthing system design 3.4 Testing of electrical installation	2,3,5	9 hrs	5 hrs				6 hrs	20 hrs
	Chapter 4: **Contracting Electrical constructions** 4.1. Electrical installation contracting and Cost estimation; 4.2. Contract document preparations	6	4.5 hrs	1.5 hr				3 hrs	9 hrs
	Total		**45.5 hrs**	**16.5 hrs**				**25 hrs**	**87 hrs**

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	5	3 hrs		3 hrs.
2	Tests	15	3 hrs	3 hrs	6 hrs.

	3	Assignments	15		6 hrs	6 hrs.
	4	Project	10	3 hrs	3 hrs	6 hrs.
	5	Lab-report	5		3 hrs	3 hrs.
					Total	24 hrs.
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50 %	3 hrs	6 hrs	9 hrs.
					Grand Total SLT	33 hrs.
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					

12	Special requirements and resources to deliver the course	1	AutoCAD
		2	Computer Lab.
		5	Industrial Visit (Industrial and Commercial installation sites)
13	Textbook and reference:	1	Guide to the Wiring Regulations 17th Edition IEE Wiring Regulations (BS 7671: 2008)
		2	Ethiopian Building Code Standard, Electrical Installation of Buildings EBCS-10.1995
		3	Brian Scaddan, Electrical Installation Work, third edition,1998
		4	J. Hyde, Electrical Installation Principles and Practices,1994
		5	Jason Livingston ,Designing with Light: The Art, Science and Practice of Architectural Lighting Design,2014
		6	B.D. Jenkins, M. Coates, Electrical Installation Calculations, Forth Edition,2008
		7	M a r k K a r l e n, J a m e s R. B e n ya, Lighting Design Basics, 2004
		8	Trevor Linsley, Advanced Electrical Installation Work, Sixth Edition, 2011
		9	Brian Scaddan, Electrical Installation Work, Ninth Edition, 2019

2.17.7.6 Power System Protection

Addis Ababa Science and Technology University						
1	College: College of Electrical and Mechanical Eng.			Department: Electrical and Computer Engineering		
2	Module Category	Specialization course		Course Code: ECEg5711		
	Course Name	Power System Protection				
3	Synopsis:	In this course we discuss about: Power system protection, Circuit breakers, Automatic generation and voltage control, Power system reliability analysis				
4	Name(s) of Academic Staff:	Shegaw Firew				
5	Semester and Year offered:	Semester:	I	Year	V	
6	Credit Hour:	3 (lec 2hrs, 0hrs Tut, 3 hrs Lab)				
7	Prerequisite/ Co-requisite:	Power System II (ECEg4708)				
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:					
	CLO1	Select the appropriate protection schemes for various applications.				
	CLO2	Analyze power system faults for balanced and unbalanced conditions.				
	CLO3	Apply the basic principles and concepts of power system protection and control on a power system.				
	CLO4	Implement circuit breakers, current transformers, voltage transformers and analyse their impact on protection scheme reliability performance.				
	CLO5	Identify, calculate, and apply settings on overcurrent, directional overcurrent, distance, differential and pilot protection for power lines, transformer, generator and bus bar protection.				
	CLO6	Apply the main functions of Supervisory Control and Data Acquisition (SCADA) and Energy management System (EMS).				
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:					

Course Learning Outcomes	Program Learning Outcomes (PO)											Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-
CLO1					√								√	√	√			√			√
CLO2		√											√	√	√			√			√
CLO3	√												√	√	√						√
CLO4			√										√	√	√				√		√
CLO5					√								√	√	√		√		√		√
CLO6					√								√	√		√					

Indicate the relevancy between the CLO and PO by ticking "√" on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)	
	1	Investigate current and voltage transformers and its impact on protection principles.
	2	Perform power system analysis subject to symmetrical and unsymmetrical faults.
	3	Connect secondary current and voltage circuits of relay protections.
	4	Select proper sets of relays and to measure characteristics of protection.
	5	Calculate relay settings and test this in different operating conditions.
	6	Perform simple relay settings
11	Distribution of Student Learning Time (SLT)	

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT) In hrs.
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			160 hrs.

	Chapter 1: **Overview of electric power systems** e. one line diagrams f. per unit quantities g. types of faults i. Symmetrical Fault Analysis 1. Balanced three phase faults 2. fault current calculations, 3. Short circuit capacity and selection of circuit breakers. ii. Unsymmetrical Fault Analysis 1. Symmetrical components and sequence networks 2. positive, negative and zero sequence 3. impedance circuits of power systems 4. unbalanced fault analysis using symmetrical components.	2	1.5 hr					2 hrs	3.5 hrs
	Chapter 2: **Basics of Power system protection** 2.1. Introduction to Protective Relaying 2.2. Power system structural considerations and bus configurations 2.3. Operating principles of relays 2.4. Relaying elements, quantities and settings 2.5. Relay types and characteristics 2.6. Overview of electromechanical relays, solid state relays and computer relays.	1, 3, 5	9 hrs	2 hrs	8.5 hrs			2 hrs	21.5 hrs
	Chapter 3: **Circuit breakers** 3.1. Operating principles of circuit breakers 3.2. Types of circuit breakers 3.3. HVDC circuit breakers 3.4. Arc and Arc extinction	4, 5, 6	11 hrs	2.5 hrs	1.5 hr			3 hrs	18 hrs
	Chapter 4: **System Transducers and Instrument Transformers** 4.1. Working principles of current transformers (CT) and potential transformers (PT) 4.2. Steady state and transient performance of CT and PT 4.3. Saturation of CT 4.4. Special connections of CTs and PTs 4.5. Coupled capacitor voltage	2,4, 5	7.5 hrs	3.5 hrs	4.5 hrs			3.5 hrs	19 hrs

	transformers (CCVT).								
	Chapter 5 : **Protection of Transmission Lines** 5.1. Over-Current Protection of Transmission Lines using 5.1.1. Instantaneous overcurrent relays 5.1.2. Definite time-delay overcurrent relays 5.1.3. Inverse time overcurrent relays 5.1.4. Coordination and setting of overcurrent relay 5.1.5. Directional overcurrent relays. 5.2. Distance Protection of Transmission Lines 5.2.1. Drawbacks of overcurrent protection, operational characteristics and R-X diagrams of simple impedance relay 5.2.2. Rreactance relay, and mho relay 5.2.3. Distance protection of a three-phase line 5.2.4. Three-stepped distance Protection.	3, 5, 6	13 hrs	3 hrs	3 hrs			2 hrs	21 hrs
	Chapter 6: Protection of Alternators 6.1. Differential Protection of Alternators 6.2. Modified Differential Protection for Alternators 6.3. Balanced Earth-Fault Protection 6.4. Stator Inter-turn Protection	3, 5, 6	1.5 hr	1.5 hr	1.5 hr			5.5 hr	10 hrs
	Chapter 7: Transformer Protection 7.1. Types of faults on transformer 7.1.1. inter-turn faults on transformers 7.1.2. incipient faults on	3, 5, 6	1.5 hr	1.5 hr	1.5 hr			5.5 hr	10 hrs

	transformers 7.2. Over current protection 7.3. Percentage differential of transformer 7.4. Magnetizing inrush current 7.5. Bucholz relay, volts per hertz protection.								
	Chapter 8: Busbar Protection 8.1. Differential protection of busbars 8.2. Stability ratio of high-impedance bus 8.3. Bus Bar differential scheme 8.4. Protection of three-phase bus bar.	3, 5, 6	1.5 hr	1.5 hr	1.5 hr			5.5 hr	10 hrs
	Chapter 9**: Power System Reliability analysis** 9.1. Definition of power system reliability and quality Interconnected systems 9.2. Reliability assessment techniques 9.3. Reliability indices; Interconnected system	4, 6	7 hrs	2 hrs				5 hrs	14 hrs
	Total		**53.5 hrs**	**17.5 hrs**	**22hrs**			**34 hrs**	**127 hrs**

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	5	1 hr.	4 hrs	5 hrs.
2	Tests	15	1.5 hr.	3.5 hr	5 hrs.
3	Assignments	15		3 hrs.	3 hrs.
4	Project	10		5 hrs.	5 hrs.
5	Lab-report	5		3 hrs.	3 hrs.
				Total	21 hrs.
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50 %	3 hrs.	9 hrs	12 hrs.
				Grand Total SLT	20 hrs

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course (e.g., software, computer lab, simulation room …etc.)	1	MATLAB/Simulink
		2	Power world software Simulink
		3	Computer Lab.
		4	Substation Visit
13	Textbook and reference:	1	Les Hewitson, Mark Brown, Ben Ramesh, Practical power system protection, 2004
		2	Y.G. Paithankar,S.R. Bhide , Fundamentals of Power System Protection, 2003
		3	Badri Ram, D N Vishwakarma, Power System Protection and Switchgear
		4	D. P. Kothari, I. J. Nagrath, Modern Power System Analysis
		5	Marko Čepin, Assessment of Power System Reliability, Methods and

			Applications
		6	J. D. Glover and M. S. Sarma, Power System Analysis and Design, Brooks/Cole, Third Edition.
		7	Prabha Kumar, Power System Stability and Control, McGraw-Hill Education.
		8	Arun G. Phadke, James S. Thorp ׃Computer Relaying for Power Systems,second edition,2009

2.17.7.7 Energy Conversion and Rural Electrification

Addis Ababa Science and Technology University			
1	College: Electrical and Mechanical Engineering		Department: Electrical and Computer Engineering
2	Course Category	Stream (focus Area) course	Course Code: ECEg5703
	Course Name	Energy Conversion and Rural Electrification	
3	Synopsis:	overview of thermodynamics, Thermal power plants, , Nuclear ,power plants, Hydropower plants, Solar energy, Biomass energy, Wind energy, Geothermal energy, Rural electrification	
4	Name(s) of Academic Staff:	Wondwosen Wubu	
5	Semester and Year offered:	Semester: I	Year: 5
6	Credit Hour:	4	
7	Prerequisite/ Co-requisite:	Engineering Thermodynamics (MEng2105)	
8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:		
	CLO1	Explain Conventional and Non-Conventional Power plant components	
	CLO2	Apply Thermodynamics principles in Conventional Power plant operations,	
	CLO3	Analyze conventional and non-conventional power plant energy and power production	
	CLO4	Assess Conventional and Non-conventional energy resource potentials,	
	CLO5	Design small scale off-grid electrical power systems.	
9	Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:		

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)												Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignment	Project	Lab-report
CLO1	√																√	√			
CLO2					√												√	√			
CLO3		√																	√	√	√
CLO4		√					√										√		√		√
CLO5			√																√	√	

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

10	Transferable Skills (if applicable) (Skills learned in the course of study which can be useful and utilized in other settings)
1	Assess Energy Resource using Software
2	Develop hybrid renewable energy using Homer Software

power 11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			

	Chapter 1: Overview of Thermodynamics 1.1 First laws of thermodynamics 1.2 second laws of thermodynamics 1.3 Carnot cycle	2	2	3				5	10 hours
	Chapter 2: Thermal Energy 2.1Thermal Power plant components 2.2 Thermal power plant Site selection 2.3 Thermal Energy and Power calculations	1,3	2	3				5	10 hours
	Chapter 3: Nuclear energy 3.1 Nuclear Power plant components 3.2 Nuclear power plant Site selection 3.3 Nuclear Energy and Power calculations	1,3	2	3				5	10 hours
	Chapter 4: Hydropower Energy 4.1. Hydro energy resource assessment 4.2 Hydro Power plant classifications 4. 3 Hydro Power Plant components 4.4 Hydro power plant Design	1,3,4,5	4	6		4		9	23 hours
	Chapter 5: Solar energy 5.1 Solar Energy resource 5.2 Solar Thermal Energy conversion 5.3 Solar Photo Voltaic and Components 5.4 Solar PV Design	1,3,4,5	4	6	3			8	21 hours
	Chapter 6: Wind energy: 6.1 Wind Energy potential Assessments 6.2 Wind Turbine 6.3 Wind Power plant components and operations **6.4** Wind Energy and power Calculations	1,3,4,5	4	6	3			8	21 hours
	Chapter 7: Geothermal energy: 7.1 Geothermal Resource 7.2 Geothermal Energy Conversion 7.3 Geothermal power plant components	1,3,4	2	3				5	10 hours

	Chapter 8: Biomass energy 8.1 Biomass Resource 8.2 Biomass Energy conversion 8.3 Biomass power plant components	1,3,4	2	3				5	10 hours
	Chapter 9: Rural Electrification 9.1 Mini Grid power plant design 9.1.1 Site Description 9.1.2 Data Collection 9.1.3 Load calculation 9.1.4 Component selection	5	2	3				6	11 hours
	Total		24	36	6	4		51	126

Assessment					
Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Tests	15	2	4	6 hours
2	Project	15	2	10	12 hours
3	Assignments	15		5	5 hours
4	Quize	5	1		1 hours
5	Choose an item.				
				Total	24 hours
Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
Final Exam		50	3	7	10 hours
				Grand Total SLT	160 hours

L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non-Face to Face
Note: indicates the CLO based on the CLO's numbering in item 9.

12	Special requirements and resources to deliver the course	1	Software
		2	Computer Lab
		3	Simulation Room
		4	Generation site visit
13	Textbook and reference:	1	Tommy deb,Power Plant Engineering, 2020
		2	V K Mehta and Rohit Mehta, Principle of power system,2017
		3	Baul Breeze, Power Generation Technologies, 2005
		4	David Infield, Leon Freris, Renewable Energy in Power Systems, 2nd edition,2020
		5	Guide on How to Develop a Small Hydropower Plant, ESHA, 2004
		6	Planning and Installing Photovoltaic Systems,2008
		7	Dr. Gary L. Johnson,wind energy systems, 2006
		8	Ahmad Hemami ,wind turbine technology wind turbine technology, 2012
		9	Pratima Bajpai ,Biomass to Energy Conversion Technologies,1st Edition,2019
		10	Wind Turbine Technology Wind Turbine Technology, Ahmad Hemami
		11	Biomass Crops: Production, Energy, And The Environment Alfred P. Haggerty

2.17.7.8 Power Systems Operation and Control

Addis Ababa Science and Technology University						
1	College: Electrical and Mechanical Engineering		Department: Electrical Engineering			
2	Course Category	Core Elective/focused Area Module	Course Code: ECEg5702			
3	Synopsis:	In this course the concept of modern power system and its operating states are reviewed. Unit commitment and economic dispatch solution techniques are discussed. The concept of optimal power flow applied on a DC network is investigated. Power system generation control modeling and single and multi-area control are performed. Method of reactive power control in a transmission system are explained.				
4	Name(s) of Academic Staff:	Yared Tassew (MSc)				
5	Semester and Year offered:	Semester:	II	Year:	5	
6	Credit Hour:	4				
7	Prerequisite/ Co-requisite:	Power System II (ECEg4708)				

8	Course Learning Outcome (CLO): At the end of the course the student will be able to do:
CLO1	Explain why interconnected power system and its operating states, why we need Economic dispatch and unit commitment and what are the constraints and solution methods
CLO2	Solve Economic Dispatch and Unit Commitment Problem
CLO3	Perform Optimal power flow for DC network
CLO4	Explain the automatic generation control and carry out a small-signal analysis of a single and multi-area system
CLO5	Select appropriate reactive power control methods for transmission system

9 Mapping of the course Learning Outcomes to the program Learning Outcomes, Teaching Methods and Assessment:

Course Learning Outcomes (CLO)	Program Learning Outcomes (PO)																					
													Teaching Methods				Assessment				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	L	T	P	O	Test	Quiz	Assignmen	Project	Lab-report
CLO1							√						√				√	√			
CLO2											√		√	√	√		√		√		√
CLO3					√								√	√	√		√		√		√
CLO4	√												√		√			√	√		
CLO5			√										√		√		√	√			

Indicate the relevancy between the CLO and PO by ticking "√"on the appropriate relevant box

11 Distribution of Student Learning Time (SLT)

Course Content Outline	CLO	Teaching and Learning Activities						Total (SLT)
		Guided learning (F2F)				Guided Learning (NF2F)	Independent Learning (NF2F)	
		L	T	P	O			
Chapter 1: Modern power system 1.2 Why interconnected system? 1.3 Power system Operating states	1	1					2	3
Chapter 2: Unit commitment and Economic Dispatch 2.1 Economic dispatch problem	1,2	6	12	9			23	50

	2.2 Economic dispatch solution methods (LP and Lagrange multiplier method)								
	2.3 Operating cost of a thermal plant								
	2.4 Economic dispatch neglecting losses and no generator limits								
	2.5 Economic dispatch neglecting losses and including generator limits								
	2.6 Economic dispatch including losses								
	2.7 Unit commitment Vs economic dispatch								
	2.8 Unit commitment constraints Spinning reserve Thermal unit commitments Other constraints								
	2.9 Unit commitment solution method (Priority-List Method)								
	Chapter 3: OPF (optimal power flow) 3.1 Introduction	3	4	8	9			18	38
	3.2 Introduction to dc power flow								
	3.3 Optimal power flow calculation combining economic dispatch and DC power flow								
	3.4 Adding line flow constraints to the linear programing solutions								
	3.5 Solving the DC optimal power flow Using Quadratic Programming								
	Chapter 4: Control of Generation 4.1. Generator Model	4	3	3	6			12	24
	4.2. Turbine Model								
	4.3. Generator Governor Model								
	4.4. Turbine-Generator-Governor System Model								
	4.5 Tie line model								
	4.5. Generation control								
	Chapter 5 Reactive Power Control 5.1 Overview of Reactive Power Control – Reactive Power	5	2	2	3			7	18
	5.2 Compensation in Transmission Systems								
	5.3Transmission Lines: Shunt and Series Compensation								
	Total		16	25	27			62	130

Assessment

Continuous Assessment		Percentage Total-50(%)	F2F	NF2F	SLT
1	Quiz	5	1	1	2
2	Tests	20	2	4	6

	3	Assignments	15	2	6	8
	4	Lab report	10	1	3	4
					Total	20
	Final Exam		Percentage 50 (%)	F2F	NF2F	SLT
	Final Exam		50	3	7	10
					Grand Total SLT	160
	L = Lecture, T = Tutorial, P = Practical, O = Others, F2F = Face to Face, NF2F = Non Face to Face Note: indicates the CLO based on the CLO's numbering in item 9.					

12	Special requirements and resources to deliver the course	1	Computer Lab
		2	MATLAB software
		3	Power World simulation software
13	Textbook and reference:	1	Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheblé, Power Generation, Operation, and Control, John Wiley and Sons, Inc., Hoboken, New Jersey, 3rd ed, 2014
		2	Antonio J. Conejo • Luis Baringo, Power System Operations, Springer International Publishing, 2018
		3	Saadat H., Power system analysis, PSA publisher,3rd ed ,2011
		4	Chakrabarti and Halder, "**Power System Analysis: Operation and Control**", PHI, 2004 Edition.
		5	S. Sivanagaraju, G. Sreenivasan, Power System Operation and Control, PEARSON, 1ed, 2009
		6	D.P. Kothari and I.J. Nagrath, "**Modern Power System Analysis**", Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.

3. Quality Management System

Quality management system can be used as an instrument to improve the system continuously, install accountability and enable compatibility with other higher education systems. The quality of the program is assessed in terms of the instruction performance and impact of program on the quality of graduates looking for a job or further studies. The following factors help to ensure the quality of the education:

- In order to maintain the level of courses, course description are prepared in detail containing course objectives, learning outcome, course outline, textbooks, references and laboratory tasks.
- Regarding instruction performance, in line with the University policy, student evaluations are taken into account. The feedbacks from the students are used to improve the quality of instruction.
- Examinations are assessed by Departmental Examination Committee to verify the level of the course's instruction.
- Industry feedback will be an integral part of the process of quality assurance. The quality of graduates is measured with the feedback obtained from the employers and stakeholders who are the immediate beneficiaries of the program and also the graduates who are able to rate their own confidence in meeting the challenges they encounter after graduation.
- Alumni contacts will be established to find out feedbacks how successful the education they had at the department has been helpful and what actions to take for further improvement on the study program.

4. Staff Profile and Resources

4.1 Staff Profile

No.	Academic Rank	Number of Staff		Subtotal
		Male	Female	
1	Professor	1	0	1
2	Adjunct Professor	-	-	-
3	Associate Professor	1	0	1
4	Assistant Professor	7	0	7
5	Senior Lecturer	-	-	-
6	Lecturer	45	4	49
7	Academic Research Assistant (ARA)	21	5	26
			Total	**83**

4.2 Resources

The department has the following hardware and computer simulation laboratories which can serve core Electrical and Computer Engineering courses.

1 Fundamentals of Electrical Engineering Laboratory
2 Electronics Laboratory
3 Digital Logic Design Laboratory
4 Embedded System Laboratory
5 Electrical Workshop Laboratory
6 Electrical Machine I Laboratory
7 Electrical Machine II Laboratory
8 Power System Laboratory
9 Communication System Laboratory
10 Instrumentation and Control Systems Laboratory
11 Computer Simulation I
12 Computer Simulation II
13 PCB Making Room

Appendices

Appendix A: PO and Course Mapping Summary

Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Logic and Critical Thinking		√	√			√						
General Psychology	√	√	√	√	√	√						
Communicative English Language Skill-I							√					
Geography of Ethiopia and the Horn							√		√			
Mathematics (for Natural Sciences)	√	√										
Physical Fitness						√	√		√		√	√
General Physics	√	√		√		√						
Emerging Technology for Engineers	√	√			√	√		√				
Introduction to Computer Programming	√	√	√									
History of Ethiopia and the Horn		√		√		√		√				
Communicative English Language Skill-II							√					
Applied Mathematics-IB	√	√										
Moral and Civic Education	√	√				√			√			
Inclusiveness				√					√			√
Social Anthropology			√			√	√		√			√
Global Trend						√	√		√		√	
Engineering Drawing					√				√	√		
Engineering Mechanics-I (Statics)	√	√	√									
Applied Mathematics-IIB	√	√										
Economics	√	√										
Engineering Mechanics-II (Dynamics)	√	√	√	√								√
Applied Mathematics-IIIB	√	√										
Computational Methods	√	√		√								
Engineering Thermodynamics	√	√										
Probability and Random Processes	√		√		√							
Applied Electronics I	√			√	√				√			
Signals and System Analysis	√	√										
Electromagnetic Fields	√	√										
Electrical Workshop Practices I	√			√		√			√			
Object Oriented Programming	√		√	√	√							
Applied Electronics II	√		√	√								
Digital Logic Design	√	√	√	√								
Network Analysis and Synthesis	√	√										
Electrical Machines-I	√				√				√			
Digital Signal Processing	√		√									

Electrical Workshop Practices II	√	√							√			
Introduction to Communication Systems	√	√	√									
Computer Architecture and Organization	√	√	√									
Introduction to Control Systems	√	√	√	√					√			
Power Systems I	√	√	√					√				
Research Methods and Presentation	√	√		√						√		
Electrical Measurement and Instrumentation	√	√	√					√				
Electrical Installation		√	√			√		√				√
Microprocessors and Interfacing	√	√	√	√	√							
Digital Communication Systems		√	√	√	√							
Data Communications and Computer Networks	√		√	√	√							
EM waves and Guide Structures	√	√		√								
Microelectronic Devices and Circuits	√	√	√									
Telecommunication Networks		√	√	√								
Microwave Devices and Systems	√	√	√	√		√						
Fiber Optics Communications	√	√	√									
Antennas and Radio Wave Propagation	√	√	√	√	√							
Wireless and Mobile Communications	√		√	√	√							
Integrated Design Project	√	√	√		√		√		√			√
Advanced Computer Networks		√	√	√	√							
Switching and Intelligent Networks	√	√		√								
Engineering Project Management			√	√	√	√						
Software Engineering	√				√		√	√	√			
Data Structures and Algorithm	√	√	√		√	√			√	√		
Database Systems	√	√	√	√								
Operating Systems	√			√	√	√						√
Embedded Systems	√	√			√							
VLSI Design	√	√	√									
Introduction to Machine Learning	√	√	√		√				√	√		
New Trends in Computer Engineering		√	√		√	√						
Robotics and Computer Vision	√		√		√				√			
Wireless Communications and Mobile Computing	√	√										
Modern Control Systems	√		√	√					√			
Digital Control Systems	√	√	√	√								
Embedded Systems for Control Engineering	√	√			√							
Power Systems II	√		√		√				√			
Electrical Machines II	√	√	√	√								
Process Control Fundamentals	√		√	√								
Industrial Automation		√	√		√	√						
Power Electronics and Electric Drive	√	√	√									
Instrumentation Engineering	√	√	√	√					√			

Artificial Intelligence for Control Engineering		√	√	√	√							
Optoelectronics	√		√	√								
Analog System Design	√	√	√	√	√							
Digital Systems Design		√	√									
IC Technology		√		√								
Power Electronics	√	√	√									
Energy Conversion and Rural Electrification	√	√	√		√		√					
Power System Protection	√	√	√		√							
Power Systems Automation		√			√	√						
Power Systems Operation and Control	√		√		√		√				√	
Industry Internship			√		√		√		√			√
B.Sc. Thesis			√		√		√		√			√
Total												
Percentage (%)												

Appendix B: Semester Course Breakdown for Continuous Education Programs (CEPs)

Core Electrical Engineering

First Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
Phil1009	Logic and Critical Thinking	3	2	3	0
Psyc1011	General Psychology	3	2	3	0
FLEn1003	Communicative English Language Skills I	3	2	3	0
GeES1005	Geography of Ethiopia and the Horn	3	2	3	0
Total		12	8	12	0

First Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
Math1007	Mathematics for Natural Science	3	2	3	0
SpSc1013	Physical Fitness	P/F	1	0	3
Phys1001	General Physics	3	2	3	0
EmTe1108	Emerging Technology for Engineers	3	2	3	0
FLEn1004	Communicative English Language Skills-II	3	2	3	0
Total		12	9	12	3

First Year, Summer Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
Math1014	Applied Mathematics IB	4	3	3	0
MCiE1012	Moral and Civic Education	2	2	0	0
Incl1010	Inclusiveness	2	2	0	0
Total		8	7	3	0

Second Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
Hist2002	History of Ethiopia and the Horn	3	2	3	0
Anth1002	Social Anthropology	2	2	0	0
Entr1106	Entrepreneurship for Engineers	3	3	0	0
Math2007	Applied Mathematics IIB	4	3	3	0
	Total	12	10	6	0

Second Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
Comp2003	Introduction to Computer Programming	3	2	0	3
MEng2101	Engineering Drawing	3	1	0	6
CEng2103	Engineering Mechanics I (Statics)	3	2	3	0
Econ2009	Economics	3	2	3	0
	Total	12	7	6	9

Second Year, Summer Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
GLTr2011	Global Trend	2	2	0	0
MEng2102	Engineering Mechanics-II (Dynamics)	3	2	3	0
ECEg2110	Probability and Random Processes	3	2	3	0
	Total	8	6	6	0

Third Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg2102	Fundamentals of Electrical Engineering	4	2	3	3
Math2042	Applied Mathematics IIIB	4	3	3	0
ECEg3103	Applied Electronics I	4	2	3	3
	Total	12	7	9	6

Third Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg3102	Applied Electronics II	3	2	0	3
ECEg3105	Signals and System Analysis	3	2	3	0
ECEg3107	Electromagnetic Fields	3	2	3	0
ECEg3109	Object Oriented Programming	3	2	0	3
	Total	***12***	***8***	***6***	***6***

Third Year, summer

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg3101	Computational Methods	3	2	0	3
MEng2114	Engineering Thermodynamics	3	2	3	0
ECEg3111	Research Methods and Presentation	2	2	0	0
	Total	8	6	3	3

Fourth Year, First Semester

Course Code	**Course Title**	**Cr. Hrs**	**Lec**	**Tut**	**Lab**
ECEg3113	Electrical Workshop Practices I	1	0	0	3
ECEg3104	Digital Logic Design	4	2	3	3
ECEg3106	Network Analysis and Synthesis	3	2	3	0
ECEg3110	Electrical Machines I	4	2	3	3
	Total	12	6	9	9

Fourth Year, Second Semester

Course Code	**Course Title**	**Cr. Hrs**	**Lec**	**Tut**	**Lab**
ECEg4101	Introduction to Communication Systems	3	2	0	3
ECEg4105	Introduction to Control Systems	3	2	0	3
ECEg4109	Power Systems I	3	2	0	3
IETP4115	Integrated Engineering Team Project	3	1	0	6
	Total	12	6	0	18

Fourth Year, Summer

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg3112	Electrical Workshop Practices II	2	1	0	3
ECEg4103	Computer Architecture and Organization	3	2	3	0
ECEg4107	Electrical Measurement and Instrumentation	3	2	0	3
	Total	**8**	**5**	**3**	**6**

Specialization courses

Communications Engineering

Fifth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg3108	Digital Signal Processing	4	2	3	3
ECEg4102	Microprocessors and Interfacing	4	2	3	3
ECEg4406	Data Communications and Computer Networks	4	2	3	3
	Total	12	6	9	9

Fifth Year, Sec ond Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4304	Digital Communication Systems	3	2	0	3
ECEg4308	EM waves and Guide Structures	3	2	3	0
ECEg4112	Integrated Design Project	3	0	0	9
ECEg5301	Microwave Devices and Systems	3	2	0	3
	Total	12	6	3	15

Fifth Year, Summer

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4100	Industry Internship	6	0	0	18
	Total	6	0	0	18

Sixth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5303	Fiber Optics Communications	3	2	0	3
ECEg5305	Antennas and Radio Wave Propagations	4	2	3	3
ECEg5307	Wireless and Mobile Communications	4	3	0	3
	Total	11	7	3	9

Sixth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5605	Microelectronic Devices and Circuits	3	2	0	3
ECEg5311	Telecommunication Networks	3	2	3	0
ECEg5302	Switching and Intelligent Networks	3	2	0	3
ECEg5410	Advanced Computer Networks	3	2	0	3
ECEg5107	Final year project I	P/F			
	Total	12	8	3	9

Sixth Year, Summer Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
IEng5104	Industrial Management and Engineering Economy	3	2	3	0
ECEg5108	Final year project II	6	0	0	18
	Total	9	2	3	18

Computer Engineering

Fifth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg3108	Digital Signal Processing	4	2	3	3
ECEg4102	Microprocessors and Interfacing	4	2	3	3
ECEg4406	Data Communications and Computer Networks	4	2	3	3
	Total	12	6	9	9

Fifth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec.	Tut	Lab
ECEg4404	Data Structures and Algorithm	4	2	3	3
ECEg5403	Embedded Systems	4	2	3	3
ECEg4112	Integrated Design Project	3	0	0	9
	Total	11	4	6	15

Fifth Year, Summer

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4100	Industry Internship	6	0	0	18
	Total	6	0	0	18

Sixth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec.	Tut	Lab
ECEg5409	Software Engineering	3	2	3	0
ECEg4410	Database Systems	3	2	0	3
ECEg5401	Operating Systems	3	2	0	3
ECEg5407	Introduction to Machine Learning	3	2	0	3
	Total	***12***	***8***	***3***	***9***

Sixth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec.	Tut	Lab
ECEg5511	Robotics and Computer Vision	3	2	0	3
ECEg5412	Wireless Communications and Mobile Computing	4	3	0	3
ECEg5402	New Trends in Computer Engineering	2	2	0	0
ECEg5405	VLSI Design	3	2	0	3
ECEg5107	Final year project I	P/F			
	Total	12	9	0	9

Sixth Year, Summer Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
IEng5104	Industrial Management and Engineering Economy	3	2	3	0
ECEg5108	Final year project II	6	0	0	18
	Total	***9***	***2***	***3***	***18***

Control Engineering

Fifth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg3108	Digital Signal Processing	4	2	3	3
ECEg4704	Electrical Machines II	4	2	3	3
ECEg4102	Microprocessors and Interfacing	4	2	3	3
	Total	12	6	9	9

Fifth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4506	Process Control Fundamentals	3	2	0	3
ECEg4510	Modern Control Systems	3	2	0	3
ECEg5507	Digital Control Systems	3	2	0	3
ECEg4112	Integrated Design Project	3	0	0	9
	Total	**12**	**6**	**0**	**18**

Fifth Year, Summer Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4100	Industry Internship	6	0	0	18
	Total	6	0	0	18

Sixth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5701	Power Electronics and Electric Drives	4	2	3	3
ECEg5509	Industrial Automation	4	2	3	3
ECEg5705	Electrical Installation	3	2	0	3
	Total	*11*	*6*	*6*	*9*

Sixth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5503	Embedded Systems for Control Engineering	3	2	0	3
ECEg5502	Instrumentation Engineering	3	2	0	3
ECEg5510	Artificial Intelligence for Control Engineering	3	2	0	3
ECEg5511	Robotics and Computer Vision	3	2	0	3
ECEg5107	Final year project I	P/F			
	Total	***12***	***8***	***0***	***12***

Sixth Year, Summer Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
IEng5104	Industrial Management and Engineering Economy	3	2	3	0
ECEg5108	Final year project II	6	0	0	18
	Total	***9***	***2***	***0***	***18***

Electronics Engineering

Fifth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg3108	Digital Signal Processing	4	2	3	3
ECEg4102	Microprocessors and Interfacing	4	2	3	3
ECEg5307	Wireless and Mobile Communications	4	3	0	3
	Total	***12***	***7***	***6***	***9***

Fifth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4304	Digital Communication Systems	3	2	0	3
ECEg4308	EM Waves and Guide Structures	3	2	3	0
ECEg4112	Integrated Design Project	3	0	0	9
ECEg5606	Analog System Design	3	2	3	0
	Total	**12**	**6**	**6**	**12**

Fifth Year, Summer

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4100	Industry Internship	6	0	0	18
	Total	6	0	0	18

Sixth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5608	Power Electronics	3	2	0	3
ECEg5604	IC Technology	3	2	3	0
ECEg5301	Microwave Devices and Systems	3	2	0	3
ECEg5605	Microelectronic Devices and Circuits	3	2	0	3
	Total	***12***	***8***	***3***	***9***

Sixth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5602	Digital Systems Design	4	2	3	3
ECEg5609	Optoelectronics	4	2	3	3
ECEg5405	VLSI Design	3	2	0	3
ECEg5107	Final year project I	P/F			
	Total	***11***	***6***	***6***	***9***

Sixth Year, Summer Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
IEng5104	Industrial Management and Engineering Economy	3	2	3	0
ECEg5108	Final year project II	6	0	0	18
	Total	***9***	***2***	***3***	***18***

Power Engineering

Fifth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg3108	Digital Signal Processing	4	2	3	3
ECEg4704	Electrical Machines II	4	2	3	3
ECEg4102	Microprocessors and Interfacing	4	2	3	3
	Total	12	6	9	9

Fifth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec.	Tut.	Lab
ECEg5709	Power Systems Automation	4	2	3	3
ECEg4112	Integrated Design Project	3	0	0	9
ECEg4708	Power Systems II	4	2	3	3
	Total	**11**	**4**	**6**	**15**

Fifth Year, Summer

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg4100	Industry Internship	6	0	0	18
	Total	6	0	0	18

Sixth Year, First Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5703	Energy Conversion and Rural Electrification	4	2	3	3
ECEg5702	Power Systems Operation and Control	4	2	3	3
ECEg5701	Power Electronics and Electric Drives	4	2	3	3
	Total	***12***	***6***	***9***	***9***

Sixth Year, Second Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
ECEg5711	Power System Protection	3	2	0	3
ECEg5502	Instrumentation Engineering	3	2	0	3
ECEg5705	Electrical Installation	3	2	0	3
ECEg4510	Modern Control Systems	3	2	0	3
ECEg5107	Final year project I	P/F			
	Total	***12***	***8***	***0***	***12***

Sixth Year, Summer Semester

Course Code	Course Title	Cr. Hrs	Lec	Tut	Lab
IEng5104	Industrial Management and Engineering Economy	3	2	3	0
ECEg5108	Final year project II	6	0	0	18
	Total	***9***	***2***	***3***	***18***

Appendix C: Washington Accord Attributes (for Engineering Programs)

Attribute	Statement
Engineering knowledge	WA1: Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
Problem analysis	WA2: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
Design/ development of solutions	WA3: Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health, and safety, cultural, societal, and environmental considerations.
Investigation	WA4: Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
Modern tool usage	WA5: Create, select, and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex engineering problems, with an understanding of the limitations.
The engineer and society	WA6: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems.
Environment and sustainability	WA7: Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts.
Ethics	WA8: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice
Individual and teamwork	WA9: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
Communication	WA10: Communicate effectively on complex engineering activities with the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective

	presentations, and give and receive clear instructions.
Project management and finance	WA11: Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work as a member and leader in a team, to manage projects and in multi-disciplinary environments.
Lifelong learning	WA12: Recognize the need for, and have the preparation and ability to engage in, in dependent and life-long learning in the broadest context of technological change.