गुरु घासीदास वश्वव द्यालय, बलासपुर

Guru Ghasidas Vishwavidyalaya, Bilaspur

A Central University established by the Central University Act 2009 No. 25 of 2009

School of Studies in Engineering & Technology

DEPARTMENT OF
ELECTRONICS & COMMUNICATION ENGINEERING

Bachelor of Technology Programme

Student's Handbook

2021 - 2022

ELECTRONICS & COMMUNICATION ENGINEERING

Student's Handbook

(2021-2022)

School of Studies in Engineering & Technology

GURU GHASIDAS VISHWAVIDYALAYA

(A Central University Established by the University Act 2009)

BILASPUR, C.G. 495009

“If you can't fly then run, if you can't run then walk, if you can't walk then crawl, but whatever you do you have to keep moving forward.”

— *Martin Luther King Jr.*

Preface

The Institute of Technology under Guru Ghasidas Vishwavidyalaya (now a Central University since 15th Jan., 2009), Bilaspur (C.G.), was set up in the year 1997 with an objective of making available the facilities of quality higher education in the field of Engineering & Technology to the students of, particularly, the Central region of the country where the rural and tribal population still remain deprived of such facilities. The Institute, remaining fully conscious of its objectives and responsibilities, is growing towards the level of a centre of excellence for quality engineering education in the country. Especially after the up-gradation of the University as a Central University, there have been many fold enhancements in infrastructural facilities as well as faculty and staff.

Today, the Institute has well equipped laboratories with latest equipment, a good library, adequate computational facilities and smart E-classrooms needed for ensuring quality in higher education and research. The Mission of the Institute is to create an ambiance in which new ideas, research and scholarship flourish and to engender the leaders and innovators of tomorrow.

The University campus houses faculties like Arts, Science, Social Science, Humanities, Law & Management etc, our students get opportunities of studying varied nature of elective courses from other faculties, and are groomed to work not only with a group of technically trained people but also with persons having knowledge indifferent domains of education.The Institute on an average, admits around 400 students annually forthe 4 - year B. Tech programme in seven branches. Admissions are made through Joint Entrance Examination (JEE) (main) or the entrance examination conducted as per the directions of MHRD, Govt. of India. Presently, M.Tech. programme is being run by two departments (Mechanical and Chemical Engineering) and the students who are Graduate Aptitude Test in Engineering (GATE) qualified get admitted. To keep pace with new developments and changes in the field of technology, the Institute revises its Undergraduate & Postgraduate Programmes syllabi from time to time.Institute follows a semester system of teaching (odd- July - December; and even- January – June).

Ours is a student-centric Institution and, therefore, the endeavor is always to ensure that students are offered the information on the existing Rules and Regulations governing the B.Tech. Programmes. The students and parents/ guardians are, therefore, advised in their own interest to getfully familiar with the academic system of the Institute and rules & regulations. Students' attention isparticularly drawn to the attendance requirement, regular assessment procedures, conditions of promotion to higher semesters and grading system,etc.

Thank you for your interest in the Institute of Technology, Guru Ghasidas Vishwavidyalaya, Bilaspur. We wish all our students a very bright future and successful career.

Dean (SOS, Engg. & Tech.)

VISION

The department endeavors for academic excellence in Electronics & Communication Engineering by imparting in depth knowledge to the students, facilitating research activitiesand catering to the ever-changing industrial demands, global and societal needs.

MISSION

The Mission of the Department of Electronics andCommunication Engineering is:

1. To be the epitome of academic rigour, flexible to accommodate every student and faculty for basic, current andfuture technologies in Electronics and Communication Engineering.

2. To provide technical expertise along with professional ethicsas per societal needs.

Program Objectives (PO)

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of theengineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverseteams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with 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.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.

Program Specific Objectives (PSO)

PSO1: Identify, formulate and apply concepts acquired through ECE courses to the real world application.

PSO2: Design and implement products using edge software and hardware tools to attain skills for analysing and developing subsystems/processes.

PSO3: Ability to adapt and comprehend the technology advancement in research and contemporary industry demands. Demonstration of leadership qualities and betterment of organization, environment, and society.

CONTENTS

About Department

Since its inception in 1998, the Department of Electronics & Communication Engineering has been imparting quality education towards B. Tech degree in the discipline of Electronics & Communication Engineering. The Department initially started with an intake of 40 students which grew to an intake of 60 students but now with an annual intake of 75 students, as looking into the social needs and job opportunities available in the market. Department has created suitable laboratories and other instructional facilities to cater the needs of academics. We have been regularly upgrading the curriculum looking into the rapid changes in technology and industrial requirements. Our students have displayed National and International standards as is evident looking into their absorption in various organizations, industries, and other institutions of national and international repute.

The Department is equipped with adequate numbers of computers with broadband connection in the campus. Department is equipped with audio visual facilities for catering effective teaching and learning. Laboratories are supported by desired software .The laboratories are adequately equipped with state of art facilities.

The department has well qualified and well-motivated staff. The research interests of the faculty members of the department encompass the **VLSI Design, Communication System, Embedded System, Signal & Image Processing, RF & Wireless Communication System, Antenna Design, Network Security and Computer Vision**. The Department also runs M.Tech. and PhD in Electronics and Communication Engineering.

The department believes in serious academic pursuit and encourages radical and original thinking which paves the way for creativity and innovative ideas. In a harmonious and respectful environment, the students are delivered quality technical education so as to respond to rapidly changing social and economic environments. Their all-round personality is developed so that they are devoted to serving the nation and community by generating and disseminating knowledge and technologies essential to the local and global needs in the field of Electronics and Communication Engineering.

Academic Calendar

GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR [C.G.]

Academic Calendar for session 2021-22 for University Teaching Department

Odd Semesters

Academic Session 2021-22

S.N	Event	5th, 7th, 9th Semesters
1.	Commencement of Class	10.08.2021
2.	1st Unit Test (Internal Assessment)	15.09.2021 to 22.09.2021
3.	Last date for showing the answer script of test to the students	27.09.2021
4.	Last date for submission of End Semester Examination form	30.09.2021
5.	2nd Unit Test (Internal Assessment)	21.10.2021 to 27.10.2021
6.	Last date for showing the answer script of test to the students	30.10.2021
7.	Practical/Project Examination, if any	28.10.2021 to 05.11.2021
8.	Last day of classes	15.11.2021
9.	End semester Examination	20.11.2021 to 10.12.2021
10.	Last date for showing the answer script of exams to the students	12.12.2021
11.	Last date for submission of final marks of End Semester Examination to COE along with evaluated manuscript (Theory + Practical)+ final marks of Internal Assessment (1st and 2nd) to COE along with evaluated manuscript (Theory + Practical)	15.12.2021

Proposed Academic Calendar (2021-22)
School of Studies of Engineering& Technology
Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur(C.G.)

B. Tech. Odd Semester (2021-2022)

S.N.	Academic Plans	III Semester(Course A/B), as per CBCS	V&VII Semester, as per CBCS
01	Registration/Admission/Orientation / Induction Programme	04.10.2021 (Monday) to 08.01.2021 (Friday)	26.07.2021 (Monday) to 30.07.2021 (Friday)
02	Commencement of Classes	04.10.2021 (Monday)	26.07.2021 (Monday)
03	Class Test-I/Class Test (Internal Assessment)	08.11.2021 (Monday) to 13.11.2021 (Saturday)	30.08.2021 (Monday) to 04.09.2021 (Saturday)
04	Class Test-II/Mid Semester Examination (MSE) (Internal Assessment)	13.12.2021 (Monday) to 20.12.2021 (Monday)	20.10.2021 (Wednesday) to 26.10.2021 (Tuesday)
05	Last date for submission of End Semester Examination (ESE) form	As per the University notification	
06	Last date of classes	07.01.2022 (Friday)	26.11.2021 (Friday)
07	Preparation leave	08.01.2022 (Saturday) to 09.01.2022 (Sunday)	27.11.2021 (Saturday) to 28.11.2021 (Sunday)
08	End Semester Examination (ESE)/Practical Examinations	10.01.2022 ((Monday) to 21.01.2022 (Friday)	29.11.2021 (Monday) to 10.12.2021 (Friday)
09	Declaration of End Semester Results	As per the University Notification	
10	Winter vacation	As per the University Notification	

B. Tech. Even Semester (2021-2022)

S.N.	Academic Plans	IV Semester(Course A/B), as per CBCS	VI&VIII Semester, as per CBCS
01	Registration/Admission/Orientation / Induction Programme	24.01.2022 (Monday) to 28.01.2022 (Friday)	13.12.2021 (Monday) to 17.12.2021 (Friday)
02	Commencement of Classes	24.01.2022 (Monday)	13.12.2021 (Monday)
03	Class Test-I/Class Test (Internal Assessment)	07.03.2022 (Monday) to 12.03.2022 (Saturday)	24.01.2022 (Monday) to 29.01.2022 (Saturday)
04	Class Test-II/Mid Semester Examination (MSE) (Internal Assessment)	18.04.2022 (Monday) to 23.04.2022 (Saturday)	14.03.2022 (Monday) to 19.03.2022 (Saturday)
05	Last date for submission of End Semester Examination (ESE) form	As per the University notification	
06	Last date of classes	13.05.2022 (Friday)	15.04.2022 (Friday)
07	Preparation leave	14.05.2022 (Saturday) to 18.05.2022 (Wednesday)	16.04.2022 (Saturday) to 20.04.2022 (Wednesday)
08	End Semester Examination (ESE)/Practical Examinations	19.05.2022 (Thursday) to 31.05.2022 (Tuesday)	21.04.2022 (Thursday) to 30.04.2022 (Saturday)
09	Declaration of End Semester Results	As per the University Notification	
10	Summer vacation	As per the University Notification	

Proposed
Draft of
ORDINANC
E No. -12

for

Bachelor of Technology (B.Tech.) Under Choice Based Credit System

Governing the award for the Degree of Bachelor of Technology (B.Tech.)-4 years (8 Semester)

Degree Course

(Ordinance prepared as per the provisions given in
Statute 28(1) (b) of The Central Universities Act, 2009)

1.1 TITLE AND COMMENCEMENT

1.2 The Ordinance shall be called as Ordinance for four years (Eight Semesters) B.Tech. Degree programme.

1.3 The first degree of four years (Eight Semester) programme in Engineering & Technology, hereinafter called 4- year B. Tech degree course, shall be designated as 'Bachelor of Technology' in respective Branches. The conduct of the programme and the performance evaluation of B. Tech. programmes are on the basis of percentage of marks earned as well as credit system.

1.4 This ordinance will come into force from the Academic Session commencing after the date of notification issued by the University and shall replace the existing ordinance.

2.1 DEFINITION & KEY WORDS

2.2 "*Vishwavidyalaya"* or "*University*" means Guru Ghasidas Vishwavidyalaya (A Central University established by the Central Universities Act, 2009 No. 25 of 2009) located at Koni, Bilaspur, Chhattisgarh.

2.3 "*Student*" means one who has been admitted in the four years B.Tech. programme of this University through merit list of Joint Entrance Examination (JEE) (main) or any other procedure decided by Guru Ghasidas Vishwavidyalaya for Admission to B. Tech. degree course time to time.

2.4 The candidate shall be eligible for admission on the basis of the *"Academic Year" means t*wo consecutive (one odd and one even) semesters.

2.5 *"Choice Based Credit System (CBCS)"* means a program that provides choice for students to select from the prescribed courses (Basic Science, Humanities, Engineering Science,

Mandatory Courses, Professional Core, Open Elective, Professional Elective, etc.) as per the guidelines issued by UGC / AICTE / regulatory bodies where ever applicable and as approved by the appropriate bodies of the University.

2.6 *"Course"* means "papers" through different modes of delivery and is a component of a programme as detailed out in the respective program structure.

2.7 *"Credit Point"* means the product of grade point and number of credits for a course.

2.8 *"Credit"* means a unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture, seminar or tutorial) per week or two hours of practical work/field work/project etc. per week. The number of credits for each course shall be defined in the respective examination scheme.

2.9 *"Cumulative Grade Point Average* (*CGPA*)" means a measure of overall cumulative performance of a student in all semesters. The CGPA is the ratio of total credit points secured by a student in various courses registered up to the semester concerned and the sum of the total credits points of all the registered courses in those semesters concerned. It is expressed up to two decimal places.

2.10 *"Grade Point"* means a numerical weight allotted to each letter grade on a 10 point scale or as prescribed by the AICTE/ University from time to time.

2.11 *"Letter Grade"* means an index of the performance of students in a course. Grades are denoted by letters O, A+, A, B+, B, C, P, and F.

2.12 *"Semester Grade Point Average* (*SGPA*)" means a measure of performance of a student in a particular semester. It is the ratio of total credit points secured by a student in various courses registered in a semester and the total credits of all courses in that semester. It shall be expressed up to two decimal places.

2.13 *"Semester"* means an academic session spread over 15-18 weeks of teaching work with a minimum 90 teaching days. The odd semester may normally be scheduled from July to December and even semester from January to June.

2.14 *"Grade Card"* means a certificate based on the grades earned. Grade cards shall be issued to all the students registered for the examination after every semester. The grade card will contain the course details (code, title, number of credits, grade secured) along with SGPA of

the semester and CGPA earned till that semester. The final semester grade card shall also reflect the cumulative total of marks obtained by the student in all semesters out of maximum marks allocated for which the grades of the program were evaluated. However, the final result will be based on the grades/CGPA.

2.15 "*Transcript"* means a certificate issued to all enrolled students in a program after successful completion of the program. It contains the SGPA of all semesters and the CGPA;

2.16 "*Ex-student*" means a student who fails to clear in the supplementary examination all the backlogs of theory, practical / sessional subjects of the odd and even semesters, he/she will not be promoted to the odd semester of the next higher year, and such student shall be treated as ex-student.

2.17 *"Sessional"* means a subject which is practiced by student in a semester for which there is no end semester exam.

3.0 DURATION

The duration of undergraduate (U.G.) degree programmes leading to B. Tech. degree, shall be normally four years and the maximum duration shall be 7 years from the date of initial registration in First year B.Tech. course. If a candidate will not be able to complete the course in the maximum duration of 7 years then he / she will not be eligible to continue the course from that point of time itself and he / she will automatically exit from the program.

4.0 ADMISSION PROCEDURE AND ELIGIBILITY

The minimum qualification for admission to the first year B. Tech. shall be the passing of Higher Secondary School Certificate Examination (10+2) scheme with Physics, Chemistry and Mathematics conducted by Central Board of Secondary Education or any other equivalent examination from a recognized Board or University. The candidate shall be eligible for admission on the basis of the merit list of Joint Entrance Examination (JEE) (main) or any other procedure decided by Guru Ghasidas Vishwavidyalaya for Admission to B. Tech. degree course time to time. In general the admission to B. Tech. degree course shall be governed by the rules of, MHRD, Government of India (GoI) and Guru Ghasidas Vishwavidyalaya.

The reservations in admission, cancellation of admission and fee refund will be as per MHRD, GoI / GGV norms and notifications issued in this regard from time to time.

5.0 ENROLMENT IN THE UNIVERSITY

Every student admitted to the programme shall be enrolled before appearing in the first semester examination through the procedure prescribed by the competent authority from time to time.

6.0 TYPES OF COURSES

Basic Science, Humanities, Engineering Science, Mandatory Courses, Professional Core, Open Elective, Professional Elective, etc. as per the guidelines issued by AICTE / University where ever applicable and as approved by the appropriate bodies of the University.

7.1 ATTENDANCE AND ELIGIBILITY TO APPEAR IN THE EXAMINATION

A Student shall be required to attend at least 75% of the classes actually held in the semester which may include theory class, seminars, sessionals, practicals, projects, as may be prescribed. Provided that the Dean of the School of Engineering & Technology on the recommendations of the concerned Head of the Department may condone the shortage in attendance of those students who have secured at least 65% attendance. This condonation should not exceed 10% on the following satisfactory grounds.

(a) Illness / Medical leave of the student certified by the University Medical Officer / Government Doctor.
(b) Unforeseen miss happening with parents.

(c) For participating in the extra and co-curricular events with prior approval from the university authority.

(d) For participating in the sports activity with prior approval from the university authority.

(e) For attending in interviews with valid proof and prior permission of the concerned head of department.

(f) Natural calamities.

The application must be supported by such documents as considered to be fit for granting such condonation.

7.1. A student who does not satisfy the requirement of attendance as per clause above, he/she will be detained due to shortage of attendance in a particular semester and he/she will have to repeat the same semester taking readmission as a regular student in the next commencing academic session by paying fee as per the University norms.

8.0 EXTRA ORDINARY LONG ABSENCE

If a student does not participate in the academic activities of the School of Studies of Engineering and Technology of this Vishwavidyalaya for a period exceeding two years for reasons of ill health or medical grounds only, he / she shall neither be permitted to appear in any subsequent examinations nor shall be admitted or promoted to any semester and he / she shall cease to be a student of B. Tech. Degree Course. Here participation in academic activity means attending Lectures, Tutorials, Practicals/Sessionals and such other activities declared as academic activities.

9.0 MEDIUM OF INSTRUCTION/EXAMINATION

Medium of instruction and examination shall be English only.

10.1 EXAMINATION AND EVALUATION

10.2 ***Practical/ Sessional Work*** – The student shall be required to complete the Laboratory / Drawing / Design / Job preparation and other academic work assigned for that semester in the session.

10.3 There shall be a full End Semester Examination at the end of each semester consisting of theory papers, practicals/ sessionals.

10.4 There shall be one End Semester Examination (ESE) at the end of each semester conducted by Guru Ghasidas Vishwavidyalaya. Only those students, who will satisfy the attendance requirement to be eligible to appear at the End Semester Examination as per clause 7.0, will be permitted to appear in the End Semester Examination. The examination will consist of theory papers, laboratory practical/sessional and viva-voce as per the scheme of examination of that semester. These examinations shall be designated as follows.

(a). During First year - I & II sem. B. Tech. Examination
(b). During Second year- III & IV sem. B. Tech Examination
(c). During Third year- V & VI sem. B. Tech. Examination
(d). During Fourth year- VII & VIII sem. B. Tech. Examination

10.5 The semester examination will normally be held in the month of November-December and April – May in every academic session, or as decided by the University from time to time.

10.6 Supplementary examinations will be held only once in a year (for both even and odd semesters) normally in the month of June/July or as decided by the University from time to time.

10.7 End Semester Examination time table shall be declared by the Controller of Examination before the commencement of examination.

10.8 Basis of Subjects Evaluation

10.8.1 For passing in a subject (theory / practical/sessional) the performance of the candidate in each semester shall be evaluated subject wise. There shall be continuous assessment throughout the semester by conducting class tests, called Internal Assessment (I.A.) carrying 30% weightage, and End Semester Examination (E.S.E.) carrying 70% weightage. A student has to secure a minimum 35% (24 marks) in the particular theory subject and minimum 40% marks in a particular practical subject to pass that subject in the end semester examination. For each practical/sessional subject 60% weightage will be given to the actual practicals

/sessionals performed during the semester I.A. and 40% weightage will be given to the End Semester Examination (ESE).

10.8.2 For evaluation of end semester practical/sessional examination of a subject, there shall be two examiners, one internal examiner who has conducted the practical in that semester and other external examiner to be appointed by the Head of the Department from amongst faculty members of the department concerned.

10.8.3 To allot the marks of Internal Assessment (IA), there shall be two Class Tests (CT) I & II each of 15 marks.

10.8.4 For passing a subject the student is required to fulfill the following conditions:

(a) Students have to secure a minimum 35% (24 marks) in a particular theory subject to pass that subject in the end semester examination.
(b) Students have to secure minimum 40% marks in a particular practical / sessional subject to pass that subject (practical / sessional) in the end semester examination.
(c) Must have secured minimum 40% marks (Marks of Internal Assessment + Marks of End Semester Examination) for each theory subject.
(d) Must have secured minimum 50% marks (Marks of Internal Assessment + Marks of End Semester Examination) for each project/practical/sessional subject.
(e) Must have scored minimum SGPA of 5.0 in the semester. If a student has cleared all the Theory and Practical/Sessional subjects of one or and both semesters of a year, but has

failed to secure SGPA of 5.0 in the semester or and semesters of a year then he/she will be allowed to re-appear in the supplementary Examination in those subjects in which the student's Grade Points less than 5. If the student fails to secure SGPA of 5.0 even in the supplementary examination, he/she will not be promoted to the odd semester of the next higher year, and such student shall be treated as an ex-student. Other condition of promotion of the ex-student will be applicable as per Clause 11.

(f) If a student has passed a semester examination in all the subjects as per clause 10.7.4 (a- e), he/she shall not be permitted to reappear in that examination for improvement in grades/division.

10.8.5 ***Basis of Credits-*** Credit of a theory or practical/sessional subject is decided by: Credit = (L+ T+P/2),

Where; L = Lecture periods per week, T=Tutorial period per week,

P = Practical/Sessional periods per week.

Credit in a subject will be an integer, not in a fractional number. If a credit in a subject turns out in fraction, it will be taken as the next integer number.

10.8.6 ***For Theory Subjects-***For the assessment of performance of students in a semester, a continuous evaluation system will be followed with two components: Internal Assessment (IA), carrying 30% weightage and End Semester Examination (ESE), carrying 70% weightage. There will be two class tests each of 15 Marks, in each theory subject in a semester forming the part of Internal Assessment (IA).

10.8.7 ***For Projects/Practical/ Sessional Subjects-*** Evaluation of project/practical/sessional during the semester will carry 60% weightage for Internal Assessment (IA) and the End Semester Examination (ESE) will carry 40% weightage. The internal assessment will carry equal weightage of attendance (20% weightage), practical records (20% weightage) and internal viva – voice examination (20% weightage). The marks for attendance shall be awarded in project/practical/sessional subject as per the following Table.

% attendance.	≤ 75	≤ 80	≤ 85	≤ 90	≤ 95	≤ 100
% weightage of marks.	0	12	14	16	18	20

10.8.8 ***Grading System-*** Percentage as well as absolute grading system will be followed, in every subject, theory or practical/sessional. A student will be awarded a **Letter Grade**, based on his combined performance of Internal Assessment (IA) and End Semester Examination (ESE). These grades will be described by letters indicating a qualitative assessment of the student's performance through a number equivalent called "Grade Point" (GP) as given below. The following is the **Grade Point** pattern. Grade 'F' indicates not clearing (passing) of the subject.

Letter Grade (LG)	O	A+	A	B+	B	C	P	F	Ab
Grade Point	10	9	8	7	6	5	4	0	0

The Letter Grades are O (Outstanding), A+ (Excellent), A (Very Good), B+ (Good), B(Above Average), C (Average), P (Pass), F(Fail) and Ab (Absent in end semester examination). Grades will be awarded for every theory and practical/sessional subject separately.

10.8.9 Absolute Grading System

(a) The Absolute Grading System as explained below will be adopted for theory and project/practical/sessional subjects.

GRADE	**Percentage of Marks Obtained**	
	THEORY	**PRACTICAL/SESSIONAL/PROJECT**
O (Outstanding)	>90- ≤100	>90-≤ 100
A^+(Excellent)	>80 - ≤ 90	>80-≤ 90
A (Very Good)	>70 - ≤ 80	>70 - ≤ 80
B^+(Good)	>60 -≤ 70	>60- ≤ 70
B (Above Average)	>50- ≤ 60	>55- ≤ 60
C (Average)	>40-≤ 50	>50-≤ 55
P (Pass)	0	=50
F (Fail)		0 - < 50

(b) 01 Grace Mark shall be given only once at the time of award of the degree to improve the Grade in overall result.

10.8.10 ***Semester Grade Point Average (SGPA)-*** Performance of a student in i^{th} semester is expressed by [SGPA]i which is a weighted average of course grade points obtained by a student in the semester and is expressed by

$$[SGPA]_i = \frac{[C_1G_1 + C_2G_2 + ...]_i}{[C_1 + C_2 + ...]_i} = \frac{[\sum C_jG_j]_i}{[\sum C_j]_i} = \frac{N_i}{D_i}$$

Where Cj stands for Credit and Gj stands for Grade points corresponding to j^{th} subject in a semester. SGPAs will be calculated up to two places of decimal without rounding off. SGPA will be calculated only when a student clears a semester without failing in any subject, theory or practical/sessional/project.

10.8.11 ***Cumulative Grade Point Average (CGPA)-*** This is a weighted average of course grade points obtained by a student for all the courses taken, since his / her admission. Thus, CGPA in the i^{th} semester with "i ≥2" will be calculated as follows:

$$[CGPA]_i = \frac{\sum_{k=1}^{k=i} N_k}{\sum_{k=1}^{k=i} D_k}$$

If a student repeats a course or is declared a failure in a subject, then only the grade points earned in the attempt when he / she cleared the course (subject) are counted towards CGPA. CGPA will be calculated in every semester along with SGPA, so that a student knows his / her latest CGPA.

11 PROMOTION TO NEXT YEAR AND SEMESTER

11.1 Those students who have cleared all the registered theory, practical/sessional subjects prescribed for the B.Tech. first year shall be promoted to the B.Tech. second year. Those students who have cleared all the registered theory, practical/sessional subjects prescribed for the B.Tech. second year shall be promoted to the B.Tech. third year. Those students who have cleared all the registered theory, practical/sessional subjects prescribed for the B.Tech. third year shall be

promoted to the B.Tech. fourth year.

11.2 Supplementary examinations will be held only once in a year (for both even and odd semesters) normally in the month of July after declaration of results of even semester examinations of the incumbent session, or as decided by the University from time to time.

11.3 Those students who would have backlogs in registered theory and/ or practical/ sessional subjects in the odd and or even semesters of any academic year will be allowed to appear in the supplementary examinations of the same year.

11.4 Those B.Tech. students who are allowed to appear in the supplementary examination (of odd or even or both semesters**),** may be allowed to attend the classes provisionally of the next higher odd semester of the next year. However, such provisionally permitted students will get their regular admission only after passing in all their backlog papers in supplementary examination, if eligible otherwise. The percentage of attendance shall be counted from the date of commencement of the semester classes.

11.5 If a student fails to clear in the supplementary examination all the backlogs of theory, practical/sessional subjects of the odd and even semesters, he/she will not be promoted to the odd semester of the next higher year, and such student shall be treated as ex-student.

11.6 Ex-students, {as per clause 10.7.4(e)}, shall be required to clear their backlog papers (theory and or practical/sessional subjects), in the end semester examination of the corresponding semesters (odd and even) and supplementary examination to be conducted next year (in the following academic session). Such ex-students will be required to deposit the examination fees only.

11.7 If a student fails to appear in the internal assessment / session of a semester due to unforeseen incident, a makeup test/examination may be conducted, if required, strictly on the recommendation of the concerned Head of the Department, and approval of the Dean (Engineering & Technology).

12 AWARD OF CLASS OR DIVISION

12.1 The class/division awarded to a student with B. Tech. Degree shall be determined by the student's CGPA after clearing all the subjects of all the eight semesters, as given below:

- First Division with Distinction or **Honours** : 7.5 ≤CGPA ≤ 10.0
- First Division : 6.5 ≤CGPA< 7.5
- Second Division : 5.0 ≤ CGPA< 6.5

12.2 Division shall be awarded to a student only after clearing all the eight semesters successfully,

and having earned at least total credit of **160** for the award of B.Tech. degree. It shall be based on the integrated performance of the candidate for all the eight semesters as per clause 10.3.

12.3 No student shall be declared to have passed the final B.Tech. course unless he/she has fully passed all the eight semesters. The results of the eighth semester of those students, who have not passed examination in any previous semester, will be withheld. Such students shall be deemed to have passed the final B.Tech. examination in the year in which they pass / clear all the subjects of all the eight semesters, within the limit of the prescribed period of the whole course.

13 TRANSCRIPT

Based on the Letter grades, grade points and SGPA and CGPA, the Vishwavidyalaya shall issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

14 CONVERSION OF CGPA / SGPA IN PERCENTAGE

There is no equivalence between the CGPA/SGPA scale and percentage. However notionally,

Percentage of particular semester = (SGPA) × 10

Percentage of B.Tech. Degree = (CGPA) × 10

15 RANKING

Only such candidates who successfully complete all courses in the programme in a single attempt shall be considered for declaration of ranks, medals etc declared and notified by the university, if any.

16 DISCIPLINE

- Every student is required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the Institute.
- Any act of indiscipline of a student reported to the concerned Head / Dean (Engineering & Technology), will be investigated and necessary action will be taken as per university rules from time to time
- Ragging of any dimension is a criminal and non-bailable offence in our country. The current State and Central legislations provide for stringent punishment, including imprisonment. Once the

involvement of a student is established in ragging, the offending student will be dismissed from the University and will not be admitted into any other Institution. Avenues also exist for collective punishment, if individuals can not be identified in this inhuman act. Every senior student, along with the parent, shall give an undertaking every year in this regard and this should be submitted at the time of admission / registration.

17 REGISTRATION REQUIREMENTS

- Every student is required to be present and register at the commencement of each semester on the day(s) fixed for and notified in the Academic Calendar from time to time.
- Late registration will be permitted with a fine as decided from time to time up to three weeks from the date of commencement of each semester as notified in the Academic Calendar from time to time. If the student does not register in the specified time he / she has to be registered in the next year in the same semester.
- Percentage attendance for all students will be counted from the date of commencement of the semester, irrespective of his/her date of registration. However, in the case of first year first semester, attendance will be counted from date of admission into the School or date of commencement of class work, whichever is later.
- Minimum 4 weeks Industrial training/Internship during summer break is compulsory after the end semester examination of sixth semester. The student has to submit the industrial training / Internship report to the concerned department at the time of registration in the seventh semester and is required to defend his/her industrial training/Internship during the seventh semester in the department.
- If a student finds his/her academic/course load heavy in any semester, or for any other valid reason, he/she may drop courses within 15 instructional days from the commencement of the semester with the recommendation of his/her Head of Department and approval of the Dean, Engineering & Technology.
- The curriculum for any semester, except for the final semester, will normally carry credits between 21 to 29.
- Minimum number of credits that a student can register in any given semester (excepting for final semester) is 15. Maximum number of credits that can be registered in a semester is 29.

However, in the final semester, a student may earn less than 15 credits if it is sufficient for him/ her to fulfill the requirements for the award of the degree.

- A student who has successfully secured ***CGPA*** equal and more than 7.0 in his/her First Year courses, can be registered for non credit courses in other departments of the university for his/her higher semesters of study. The registration in non credit courses will be done after recommendation of Head of the Department and approval of the Dean, Engineering & Technology followed by the same of the Head of the Department concerned of the non credit course offered in. The student has to attend the classes of the non credit courses in addition to fulfilling the requirements of registered regular subjects in his/her department prescribed by the Head of Department. For non credit courses "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

18 TRANSFER OF CREDITS

With due approval the courses studied through on line / off line like Massive Open online Courses (MOOCS) through National Programme on Technology Enhanced Learning (NPTEL) under Study Webs of Active –Learning for Young Aspiring Minds (SWAYAM) in Indian/ Foreign University/Institutions by the students during their study period at GGV Bilaspur (C.G.) may count towards the credit requirements for the award of B.Tech. degree. The credit transferred will reduce the number of courses to be registered by the student at GGV. The guidelines for such transfer of credits are as follows.

- On successful completion of the courses opted by students under SWAYAM, the credits earned by them shall be included in their Grade card.
- Credits transferred will not be used for SGPA/CGPA computations except SWAYAM. However, credits transferred will be considered for overall credits requirements of the programme.
- Students can earn credits only from other department of the University (GGV) / IISC/IITs/NITs/Central Universities and other Indian and Foreign Institutions/Universities with which GGV has an MOU (and that MOU must have specific clauses for provisions of credit transfer by students).
- Credit transfer can only be considered for the courses at the same level (i.e., UG, PG, etc.).
- The credits / grades indicated in the grade sheet obtained from the university in which the student has completed the courses should be used by the student as part of his/her transcripts.

19 INTERPRETATION OF REGULATION

In case of any dispute in the matter of interpretation of this Ordinance, the decision of the Vice-Chancellor of the University shall be final and binding on the students.

20 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council of the University has the right to propose any modifications or amendments to the Executive Council for final decision of the above regulations and further actions from time to time.

21 Matters not covered in this Ordinance shall be governed by the relevant ordinance of the University.

Scheme and Syllabus

SCHEME FOR EXAMINATION												
BTECH (FOUR YEAR) DEGREE COURSE												
FIRST YEAR, ELECTRONICS AND COMMUNICATION ENGINEERING												
SEMESTER I (Course B)												
EFFECTIVE FROM SESSION 2021-22												
	S. No	**Subject Code**	**Subjects**	**Period/Week**			**Scheme of Evaluation**				**Grand Total**	**Credits**
							Internal Assessment (IA)			**ESE**		
			Theory	**L**	**T**	**P**	**CT-I**	**CT-II**	**Total**			
	1	EC01TBS01	MATHEMATICS-II	3	1	0	15	15	30	70	100	4
	2	EC01TBS02	CHEMISTRY	3	1	0	15	15	30	70	100	4
	3	EC01TES01	PROGRAMMING FOR PROBLEM SOLVING	3	0	0	15	15	30	70	100	3
	4	EC01TES02	ENGINEERING MECHANICS	3	0	0	15	15	30	70	100	3
		Practical										
	1	EC01PBS01	CHEMISTRY LAB	0	0	3	-	-	30	20	50	1.5
	2	EC01PES01	PROGRAMMING FOR PROBLEM SOLVING LAB	0	0	3	-	-	30	20	50	1.5
	3	EC01PES02	WORKSHOP & MANUFACTURING PRACTICES	1	0	3	-	-	30	20	50	2.5
	4	EC01PES03	ENGINEERING MECHANICS LAB	0	0	2			30	20	50	1
	5	EC01PMC01	INDUCTION TRANNING PROGRAMME*	-	-	2	-	-	-	-	-	-
											Total Credits	20.5

L - Lecture Hours, T-Tutorial Hours, P - Practical Hours, CT - Class Test, ESE – End Semester Exam;
*** Mandatory Training Programme**

SCHEME FOR EXAMINATION											
BTECH (FOUR YEAR) DEGREE COURSE											
FIRST YEAR, ELECTRONICS AND COMMUNICATION ENGINEERING											
SEMESTER II (Course A)											
EFFECTIVE FROM SESSION 2021-22											
S. No	**Subject Code**	**Subjects**	**Period/Week**			**Scheme of Evaluation**				**Grand Total**	**Credits**
						Internal Assessment (IA)			**ESE**		
		Theory	**L**	**T**	**P**	**CT-I**	**CT-II**	**Total**			
1	EC02TBS03	PHYSICS	3	1	0	15	15	30	70	100	4
2	EC02TES03	BASIC ELECTRICAL ENGINEERING	3	1	0	15	15	30	70	100	4
3	EC02TBS04	MATHEMATICS-I	3	0	0	15	15	30	70	100	4
4	EC02THS01	ENGLISH	3	0	0	15	15	30	70	100	3
5	EC02TMC01	ENVIRONMENTAL SCIENCES	3	0	0	-	-	-	-	-	0
		Practical									
1	EC02PBS02	PHYSICS LAB	0	0	3	-	-	30	20	50	1.5
2	EC02PES04	BASIC ELECTRICAL ENGINEERING LABORATORY	0	0	2	-	-	30	20	50	1
3	EC02PES05	ENGINEERING GRAPHICS & DESIGN	1	0	3	-	-	30	20	50	2.5
										Total Credits	20

L - Lecture Hours, T-Tutorial Hours, P - Practical Hours, CT - Class Test, ESE – End Semester Exam; * Mandatory Course

SYLLABUS	**(SEMESTER-I)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	EC01TBS01	L	T	P	CT-1	CT-II	TOTAL	70	100	4
Subject:	MATHEMATICS-II	3	1	0	15	15	30			

Course Content:

Probability and Statistics

Module 1: Basic Probability: *(12 lectures)*
Probability spaces, conditional probability, independence; Discrete random variables,Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent randomvariables; Expectation of Discrete Random Variables, Moments, Variance of a sum,Correlation coefficient, Chebyshev's Inequality.

Module 2: Continuous Probability Distributions: *(4 lectures)*
Continuous random variables and their properties, distribution functions and densities, normal,exponential and gamma densities.

Module 3: Bivariate Distributions: *(4 lectures)*
Bivariate distributions and their properties, distribution of sums and quotients, conditionaldensities, Bayes' rule.

Module 4: Basic Statistics: (8 lectures)
Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions:Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

Module 5: Applied Statistics: (8 lectures)
Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion,difference of proportions, single mean, difference of means, and difference of standard deviations.

Module 6: Small samples: (4 lectures)
Test for single mean, difference of means and correlation coefficients, test for ratio of variances- Chi-square test for goodness of fit and independence of attributes.

Suggested Text/Reference Books

(i) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
(ii) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal BookStall, 2003 (Reprint).
(iii) S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
(iv) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

(v) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi publications, Reprint, 2010.
(vi) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.(vii)Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

SYLLABUS	**(SEMESTER-I)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	EC01TBS02	L	T	P	CT-1	CT-II	TOTAL	70	100	04
Subject:	CHEMISTRY	3	1	0	15	15	30			

Course Learning Objectives:

The objective of this Course is to:

- To make aware and enrich the students about the basic concept and understanding of chemical concepts of basic Chemistry and spectroscopic techniques.

Course Content:

UNIT-1:Concept of Quantum Energy and Spectroscopy: Quantization of Energy, Regions of spectrum. Electronic Spectroscopy: Electronic Transition, Woodward Fiesher rules for calculating λ_{max} of conjugated dienes & α, β-unsaturated carbonyl compound, various shifts in λ_{max} and intensities. Infra-Red Spectroscopy: Conditions for Infra-Red Spectroscopy, Molecular vibrations & factors affecting Infra-Red frequencies**. [8L]**

UNIT-2:Chemical Bonding in Molecules: Introduction of chemical bonding, VSEPER Theory, V.B.Theory and Molecular Orbital Theory. Energy level diagrams of diatomic molecules and ions. **. [16L]**

UNIT-3: Concept of Chirality, Enentiomers, Diastereomers,Meso-compounds and Recimic mixtures. Conformation of Acyclic hydrocarbons (Ethane, Propane & n-Butane) and cyclic hydrocarbon (Cyclohexane), Plane of symmetry, Centre of symmetry, Absolute and Relative Configuration (R &S, D & L and E & Z). **. [8L]**

UNIT -4: Reactivity of Organic Molecules, Factors influencing acidity, basicity and nucleophilicity of molecules, kinetic vs thermodynamic control of reactions. **. [12L]**

UNIT -5: Strategy for Synthesis of Organic Compounds: Reaction intermediates: Stability of Free Radicle, Carbocation and Carbanion. Introduction to reaction involving Addition, Elimination, Substitution and Ring opening and Cyclization. **. [16L]**

Text Books:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publication Co.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.
3. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition (second).
4. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015 edition.
5. A textbook of Engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
6. Applied Chemistry by H.D. Gesser, Springer Publishers
7. Textbook of Nano-science and nanotechnology by B.S. Murthy, P. Shankar and others, University Press, IIM
8. B. Siva Shankar, “Engineering Chemistry”, Tata Mc Graw Hill Publishing Limited, 3rd Edition, 2015.
9. S. S. Dara, Mukkanti, “Text of Engineering Chemistry”, S. Chand & Co, New Delhi, 12th Edition, 2006.
10. C. V. Agarwal, C. P. Murthy, A. Naidu, “Chemistry of Engineering Materials”, Wiley India, 5th Edition, 2013.

11. R. P. Mani, K. N. Mishra, “Chemistry of Engineering Materials”, Cengage Learning, 3rd Edition, 2015.

Course Outcomes- At the end of the course the students will be able to understand and solve the practical problems of their higher Engineering classes on the basis of understanding of Chemistry developed in their B. Tech. I sem classes.

SYLLABUS	**(SEMESTER-I)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	EC01TES01	L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject:	PROGRAMMING FOR PROBLEM SOLVING	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the basic of Idea of Algorithm.
- To understand the programing concept ofArithmetic expressions and Basic Algorithms
- To learn the Functions and Structure of array.

Course Content:

UNIT-1:Introduction to Programming (3 lectures)
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) -
Idea of Algorithm (3 lectures): steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples.
From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

UNIT-2: **Arithmetic expressions and precedence (12 lectures)**
Conditional Branching and Loops
Writing and evaluation of conditionals and consequent branching
Iteration and loops
Arrays (6 lectures) Arrays (1-D, 2-D), Character arrays and strings

UNIT-3:Basic Algorithms (6 lectures)
Searching,concept of binary search etc, Basic Sorting Algorithms Bubble sort etc,Finding roots of equations, introduction of Algorithm complexity

UNIT-4:Function (5 lectures)
Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference binary search etc
Recursion functions (5 lectures) Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, etc.

UNIT -5:Structure(4 lectures)
Structures, Defining structures and Array of Structures
Pointers (3 lectures) Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Suggested Text Books

(i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

(i) Brian W. Kernighan and Dennis M. Ritchie, the C Programming Language, Prentice Hall of India

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

- Develop the algorithm and programmes for various applications using Arithmetic expressions, arrays, pointers and Functions.

SYLLABUS	**(SEMESTER-I)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	EC01TES02	L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject:	ENGINEERING MECHANICS	3	0	0	15	15	30			

Course Learning Objectives:

To learn about

- The concepts Force systems, free body diagrams, resultant of forces and equations of equilibrium, Supports and support reactionsandcalculation of Centroid
- The Concept of moment of inertia of plane figures, Laws and applications of friction
- The Analysis of the truss and determination of axial forces by Method of Joints
- Motion of a body and their relationships and application of D Alembert's principle in rectilinear and curvilinear motions

Course Content:

UNIT- 1: Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems

UNIT-2: Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies.
Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; Simple Trusses; Zero force members.

UNIT 3: Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections.

UNIT-4: Virtual Work and Energy Method-Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency.
Review of particle dynamics- Rectilinear motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

UNIT-5: Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;

Text/Reference Books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall

2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill

3. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press

4. Shanes and Rao (2006), Engineering Mechanics, Pearson Education, 6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education

5. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications

6. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.

7. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

Course Outcomes- On successful completion of teaching-learning and evaluation activities, a student would be able to

- Identify and analyse the problems by applying the fundamental principles of engineering mechanics and to proceed to research, design and development of the mechanical systems.
- Construct free body diagrams and use appropriate equilibrium equations, Calculate unknown forces in a plane by resolution of force and equilibrium equations
- Locate Centroid of composite figures and determine moment of plane figures
- Analyze the systems with friction
- Determine the axial forces in the members of determinate truss.
- Calculation of acceleration, velocity and displacement and forces
- Calculation of angular displacement, velocity and angular acceleration of rotational bodies

SYLLABUS	**(SEMESTER-I)**	CREDITS: 1.5			INTERNAL ASSESSMENT (IA)			ESE
Subject Code:	EC01PBSO1	L	T	P	IA	MSE	TOTAL	
Subject:	CHEMISTRY LAB	0	0	3	30	-	30	20

Course Learning Objectives:

The Lab sessions would help in learning:

- Application of iodimetrically& titration in lab.
- Recognition of different chemical reaction.
- Advanced lab methods like spectrophotometery and chromatography

Course Content: **LIST OF EXPERIMENTS**

Group – A:

1. Standardization of sodium thiosulphate solution by standard potassium dichromate solution.
2. To determine the Normality and Strength (g/L) of given Ferrous Ammonium Sulphate solution 'A' using standard Ferrous Ammonium Sulphate (N/30) solution 'B' taking KMnO4 solution as an intermediate.
3. To determine the concentration of hypo solution ($Na_2S_2O_3.5H_2O$) iodimetrically with given Iodine (N/50) solution.
4. Find out the Temporary hardness of given water sample using 0.01M EDTA solution, buffer solution (pH-10) and EBT as an indicator.
5. To determine chloride ion in a given water sample by Argentometric method (Mohr's method)

Group – B:

6. Preparation of Urea Formaldehyde resin.
7. Acetylation of Primary Amine: Preparation of Acetanilide.
8. Base Catalyzed Aldol Condensation: Synthesis of Dibenzalpropanone.
9. [4+2] Cycloaddition Reaction: Diels-Alder reaction.
10. Preparation of Asprin and calculate its yield.

Group – C:

11. To calculate the λ_{max} of a given compound using UV-visible spectrophotometer.
12. To separate the metallic ions by paper chromatography.
13. To determine the surface tension of a liquid by stalagmometer.
14. To determine the percentage composition of the given mixture consisting of two liquids A and B (non- interacting system) by viscosity method.
15. To determine the relative viscosity of given liquids by Ostwald's viscometer.

Note: At least two Experiments from each group must be performed.

Course Outcomes-On completion of the course, the students will be able to handle the chemicals of synthesis as well as titration that will ultimately make them efficient and develop their future chemistry laboratory skills

SYLLABUS	**(SEMESTER-I)**	CREDITS: 1.5			INTERNAL ASSESSMENT (IA)			ESE
Subject Code:	EC01PES01	L	T	P	IA	MSE	TOTAL	
Subject:	PROGRAMMING FOR PROBLEM SOLVING LAB	0	0	3	30	-	30	20

Course Learning Objectives:

- To learn the Branching and logical expressions and Loops
- To learn the Arrays and Function
- To understand the Numerical methods and Recursion

Course Content:
The laboratory should be preceded or followed by a tutorial to explain the approach or Algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical Integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

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

- Utilization of Branching and logical expressions and Loops, Arrays and Function and Numerical methods and Recursion for writing the programmes for various engineering applications

SYLLABUS	**(SEMESTER-I)**	CREDITS: 2.5			INTERNAL ASSESSMENT (IA)			ESE
Subject Code:	EC01PES02	L	T	P	IA	MSE	TOTAL	
Subject:	WORKSHOP & MANUFACTURING PRACTICES	1	0	3	30	0	30	20

Course objectives:

- To impart student knowledge on various hand tools for usage in engineering applications.
- Be able to use analytical skills for the production of components.
- Design and model different prototypes using carpentry, sheet metal and welding.
- Make electrical connections for daily applications.
- To make student aware of safety rules in working environments.

Course Content:

Lectures & videos: (10 hours)

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 lectures)
2. CNC machining, Additive manufacturing (1 lecture)
3. Fitting operations & power tools (1 lecture)
4. Electrical &Electronics (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding, glass cutting (1 lecture)
7. Metal casting (1 lecture)
8. Welding (arc welding & gas welding), brazing (1 lecture)

Suggested Text/Reference Books:

(i) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishersprivate limited, Mumbai.
(ii) Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology",4th edition, Pearson Education India Edition, 2002.
(iii) Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
(iv) Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
(v) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata Mc-GrawHill House, 2017.

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

- Make half lap joint, Dovetail joint and Mortise &Tenon joint
- Produce Lap joint, Tee joint and Butt joint using Gas welding
- Prepare trapezoidal tray, Funnel and T-joint using sheet metal tools
- Make connections for controlling one lamp by a single switch, controlling two lamps by a single switch and stair case wiring

SYLLABUS	**(SEMESTER-I)**	CREDITS: 1			INTERNAL ASSESSMENT (IA)			ESE
Subject Code:	EC01PES03	L	T	P	IA	MSE	TOTAL	
Subject:	ENGG MECHANICS LAB	0	0	2	30	0	30	20

Course objectives:

- To perform the practical giving basic understanding to fundamental principles of mechanics like parallelogram of forces, triangle of forces and polygon of forces by universal force table
- To perform the practical giving basic understanding to fundamental application of mechanics like screw jack, winch crab and simple wheel and axle

Course Content:

List of Experiments

1. Verification of law of parallelogram of forces.
2. Verification of law of triangle of forces.
3. Verification of law of polygon of forces by universal force table.
4. Verification of law of moment by parallel forces apparatus.
5. Practical verification of forces in the member of jib crane.
6. Practical verification of forces in the member of the truss.
7. Determination of coefficient of friction between two given surfaces by inclined plane method.
8. Determination of efficiency of simple screw jack.
9. Determination of efficiency of single purchase winch crab.
10. Determination of efficiency of double purchase winch crab.
11. Determination of efficiency of simple wheel and axle.

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

- Verify the fundamental principles of mechanics like pparallelogram of forces, triangle of forces and polygon of forces by universal force table
- Analyse the friction coefficient between two surfaces
- Calculate the efficiency of screw jack, winch crab and wheel and axle

SYLLABUS	**(SEMESTER-II)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	EC02TBS03	L	T	P	CT-1	CT-II	TOTAL	70	100	04
Subject:	PHYSICS	3	1	0	15	15	30			

Course Learning Objectives:

- To know the basic principles, effects and applications such as physical, optical parameters used for Engineering applications.
- To learn about various laws and applications of electromagnetic theory.
- To know the basic structure, working principles and applications of lasers and optical fibre communication.
- To know the basics of semiconductor physics, semiconductor materials and devices and its characterization for advance technological applications
- To familiarize the basis of quantum theory and to make students to solve the physical problems for advancement of the technology.

Course Content:

Unit-1: Optics: Interference and Diffraction

Introduction, Young's experiment theory of interference, Coherent and non-coherent sources, Fresnel's Bi-prism and Newton's ring experiment.

Diffraction of light, Fresnel and Fraunhofer's diffraction, diffraction due to plane diffraction grating.

Unit-2 Electromagnetic Theory

Coulomb's law electrostatics field and potential, electric flux, Gauss' law, Poisson's and Laplace's equation. Equation of continuity for charge conservation, Ampere's and Faraday's laws, Maxwell's Electromagnetic equations.

Unit-3 Laser and Fiber optics

Introduction, elementary idea of spontaneous and stimulated emission, active medium population inversion, Einstein's coefficients, Types of lasers and important applications of lasers.

Introduction to optical fibers, basic principles of optical fiber, critical angle numerical aperture, maximum acceptance angle, classification of optical fiber.

Unit-4 Semiconductor physics and Devices

Formation of energy in solids, Energy band gap of metals, insulators and semiconductors, classification of semiconductor: Intrinsic and Extrinsic semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, Electrical conductivity in conductors and semiconductors, working of P-N junction diodes and Bipolar junction transistor.

Unit-5 Introduction to Quantum Mechanics

Introduction to QuantumMechanics, photoelectric effect, Compton effect, wave-particle duality, uncertainty principle, wave function, De-Broglie waves, phase and Group velocity, Davisson and Germer experiment, Schrodinger wave equation, particle in a box (I-Dimentional)

Text Books and References

1. Applied physics-I and II By Navneet Gupta, Dhanpat Rai & Co.
2. Engg. Physics by S.K.Srivastava and R.A. Yadav, New Age Pub. New Delhi

3. Engg. Physics by Uma Mukherjee, Narosa Publication.
4. Engg. Physics by M.N. Avadhanulu, S. Chand Pub.
5. Electricity and Magnetism by Rangwala and Mahajan, Tata McGraw Hill. 1998
6. Concepts of Physics Part-II by H.C.Verma, BharatiBhawan (P&D), 1998
7. Modern physics by Beiser, McGraw Hill Inc. New York, Publication 1995
8. Modern physics by Mani and Mehta, East-West Press Pvt.Ltd.1998
9. Introduction to Electrodynamics, David Griffith
10. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc.(1995).
11. B.E.A. Saleh and M.C. Teich, Fundamentals of Photonics, John Wiley & Sons. Inc.2007).
12. S.M. Sze, Semiconductor Devices: physics and Technology, Wiley (2008)
13. Yariv and p.yeh, Photonics Optical Electronics in Modern Communications, Oxford University press, New York (2007)
14. P. Bhattacharya, Semiconductor Optoelectronic Devices, prentice Hall of India (1997)
15. Online course: "Semiconductor Optoelectronics" by M. R. Shenoy on NPTEL.
16. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak on NPTEL.

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

- Student's ability to understand the basic principles and applications of physical optics for physical parameters measurements such as length, thickness, aperture size etc.
- Student's will be able to design, characterized the lasers and optical fibres and their effective utilization in optical communications, imaging etc.
- Students demonstrate appropriate competence and working knowledge of laws of electromagnetic theory and semiconductor physics and devices for their advance applications

SYLLABUS	**(SEMESTER-II)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	EC02TES03	L	T	P	CT-1	CT-II	TOTAL	70	100	04
Subject:	BASIC ELECTRICAL ENGINEERING	3	1	0	15	15	30			

Course Learning Objectives:

- To impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
- To provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.
- To explain the working principle, construction, applications of DC machines, AC machines & measuring instruments.
- To Highlight the importance of transformers in transmission and distribution of electric power.

Course Content:

***Module*-1**: **DC Circuits (8 hours)**
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

***Module*- 2**: **AC Circuits (8 hours)**
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

***Module*- 3: Transformers (6 hours)**
Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

***Module*- 4: Electrical Machines (8 hours)**
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

***Module* - 5: Power Converters (6 hours)**
DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

***Module* – 6: Electrical Installations (6 hours)**
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text / Reference Books
(i)D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
(ii)D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

(iii)L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
(iv)E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
(v) V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes:

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

- Predict the behaviour of any electrical and magnetic circuits.
- Formulate and solve complex AC, DC circuits.
- Identify the type of electrical machine used for that particular application.
- Realize the requirement of transformers in transmission and distribution of electric power and other applications.
- Understand the function on multi-disciplinary teams.

SYLLABUS	**(SEMESTER-II)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	EC02TBS04	L	T	P	CT-1	CT-II	TOTAL	70	100	04
Subject:	MATHEMATICS-I	3	1	0	15	15	30			

Course Content

Module 1*:*Calculus (6 lectures)
Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2*: *Calculus (6 lectures)
Rolle'sTheorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3: Sequences and series:(10 lectures)
Convergence of sequence and series, tests for convergence, power series, and Taylor's series. Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem. Asymptotes: definition, properties and problems.

Module 4: **Multivariable Calculus** ***(Differentiation):(8 lectures)***
Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 5: Matrices (10 lectures)
Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigen values and eigen vectors; diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11 Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

SYLLABUS	(SEMESTER-II)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	EC02THS01	L	T	P	CT-1	CT-II	TOTAL	70	100	03
Subject:	ENGLISH	3	0	0	15	15	30			

Course Learning Objectives

- To build up word power, to brush up the knowledge of English grammar, to develop good writing and speaking skills in the students

Course Content:

1. Vocabulary Building

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

2. Basic Writing Skills

Sentence Structures , Use of phrases and clauses in sentences , Importance of proper punctuation , Creating coherence , Organizing principles of paragraphs in documents , Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

4. Nature and Style of sensible Writing

Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion.

5. Writing Practices

Comprehension, Précis Writing, Essay Writing.

6. Oral Communication (This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Suggested Readings:

(i) Practical English Usage. Michael Swan. OUP. 1995.
(ii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iii)On Writing Well. William Zinsser. Harper Resource Book. 2001
(iv) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Course Outcome: At the end of the course students will be able

- learnt a lot of new words. They also learnt the particularities and peculiarities of English grammar. As a result, they could speak and write English with the least possible error

SYLLABUS	(SEMESTER-II)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	EC02TMC01	L	T	P	CT-1	CT-II	TOTAL	--	--	00
Subject:	ENVIRONMENTAL SCIENCES	3	0	0	--	--	--			

Course Learning Objectives:

- To learn the importance of Ecosystems, Natural Resources and Energy resources
- To learn the importance of Biodiversity and Environmental pollution
- To understand the Environmental ethics

Course Content:

Introduction to environmental studies Multidisciplinary nature of environmental studies: scope and importance: Concept of sustainability and sustainable development. Ecosystems: structure and function of ecosystem: Energy flow in an ecosystem: food chains. Food webs and ecological succession a) Forces: ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, Streams lakes, rivers, Oceans, estuaries). Natural Resources Renewable and Non-renewable Resources: Land resources and land use change: Land degradation, soil erosion and desertification. Deforestations: Causes and impacts due to mining, dam building on environment, forests biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts. Conflicts over water (international & inter-state) Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies Biodiversity and Conservation: Levels of biological diversity: genetic species and ecosystem diversity. Bio geographic zones of India.

Biodiversity patterns and global biodiversity hot spots India as a mega-biodiversity nation. Endangered and endemic species of India. Threats to biodiversity: Habitat loss poaching of wildlife man wildlife conflicts, biological invasions: Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and informational value. Environmental pollution: Environmental pollution types, causes, effects and controls: Air, Water, soil and noise pollution. Nuclear hazards and human health risks. Solid waste management: Control measures of urban and industrial waste. Pollution case studies. Environmental potencies & practices, Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment laws Environment protection Act: air (prevention & Control of pollution) Act: water (prevention and control of pollution) Act: wildlife protection Act: Forest Conservation Act; International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD), Nature reserves. tribal populations and rights, human wildlife conflicts in Indian context. Hunan Communities and the Environment. Human population growth: Impacts on environment. Human health and welfare. Resettlement and rehabilitation of project affected persons: case studies. Disaster management: floods, earthquake, cyclones and landslides. Environmental movements Chipko, silent valley Bishnois of Rajasthan. Environmental ethics: role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e. g.CNG vehicles in Delhi). Field work: visit to an area to document environmental assets. River/ forest/flora/fauna, etc. Visit to a local polluted site-urban/rural/Industrial/Agricultural. Study of common plants birds and basic principles of identification Study of simple ecosystems-pond river-etc.

Suggested Readings:

1. Gleick P.H.1993 Water in Crisis Pacific Institute for Studies in Dev. Environment & Security Stockholm Env. Institute Oxford Univ.press.
2. Grumbine.R. Edward and pandit M.K.2013 Threats from India's Himalaya dams Science 339;36—37
3. Sengupta R 2003 Ecology and economics: An approach to sustainable development OUP.
4. sodhi, N.S.Gibson L.& Raven P.H.(eds) 2013 Conservation Biology: Voices from the Tropics john wiley& Sons.

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

- To understand the importance of Ecosystems, Natural Resources and Energy resources, learn the importance of Biodiversity and Environmental pollution and understand the Environmental ethics

SYLLABUS	**(SEMESTER-II)**	CREDITS: 1.5			INTERNAL ASSESSMENT (IA)			ESE
Subject Code:	EC02PBS02	L	T	P	IA	MSE	TOTAL	
Subject:	PHYSICS LAB	0	0	3	30	-	30	20

Course Learning Objectives:

- To learn and perform the various practical related to optical components characterization, semiconductor material and devices characterization and know their applications in advance areas such as communication, industries, defence, navigation etc.

Course Content:

LIST OF EXPERIMENTS:

1. To determine the wavelength of sodium light with help of Fresnel's Bi-prism.
2. To determine the refractive index and dispersive power of the material of prism with the help of spectrometer.
3. To determine the sodium light by Newton's ring method.
4. To determine the wavelength of sodium light by plane diffraction grating using spectrometer.
5. To demonstrate the diffraction pattern and determine the wavelength of different colours of mercury (white) light using plane diffraction grating and spectrometer.
6. To determine the wavelength and number of line per cm on a diffraction grating using semiconductor laser diode.
7. To determine the specific rotation of sugar solution with the help of polarimeter.
8. Determine the width of the single slit and diameter of circular aperture using Fraunhofer diffraction pattern produced by semiconductor laser diode.
9. To determine the energy band gap (E_g) of a semiconductor material using P-N junction diode.
10. To determine the e/m ratio by the Thomson's method.
11. To study the P-N junction diode characteristics, in forwarded and reverse bias conditions.
12. To study the Zener diode characteristics.
13. To study the characteristics and gain of Transistor in C-B and C-E mode.
14. Determine the Planck's constant.

Course Outcomes: On completion of the course, the students would be able to:

- Know about basic optical facts and phenomenon, characterization of optical components and devices
- To know the basic semiconductor materials and devices and their applications
- To know how the performance of semiconductor devices can be improves.

SYLLABUS	**(SEMESTER-II)**	CREDITS: 01			INTERNAL ASSESSMENT (IA)			ESE
Subject Code:	**EC02PES04**	L	T	P	IA	MSE	TOTAL	
Subject:	BASIC ELECTRICAL ENGINEERING LAB	0	0	2	30	0	30	20

Course Learning Objectives:

1. To understand basic electrical wiring, measurements, and method.
2. To get acquainted with different measuring instruments.
3. To practically provide the concept of different theorems.
4. To make students understand d measurement errors.
5. To have actually hands-on on machines like transformers to get better understanding.

Course Content:

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
  Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope).
- Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and
  Verification. Observation of phase differences between current and voltage. Resonancein R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidalwave-shapeduetoB-Hcurvenonlinearityshouldbeshownalongwitha discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).
- Phase-shifts between the primary and secondary side. Cumulative three-phase power
  in balanced three-phase circuits.
- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load.
  Control of voltage through field excitation.
- Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the
  use of dc-ac converter for speed control of an induction motor and (d) Components of
  LT switchgear.

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

- Construct circuits and measure different electrical quantities.
- Analyze Single Phase and Three phase AC Circuits, the representation of alternating quantities and determining the power in these circuits
- Acquire knowledge about different types of meters and take readings.
- Work on machines like transformers

SYLLABUS	**(SEMESTER-II)**	CREDITS: 2.5			INTERNAL ASSESSMENT (IA)			ESE
Subject Code:	EC02PES05	L	T	P	IA	MSE	TOTAL	
Subject:	ENGINEERING GRAPHICS & DESIGN LAB	1	0	3	30	0	30	20

Course Learning Objectives:

- To learn the basic of Engineering Drawing and Orthographic Projections
- To learn the Sections and Sectional Views of Right Angular Solids
- To learn the Isometric Projections covering and overview of Computer Graphics

Course Content:

UNIT-I

Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

UNIT-II

Orthographic Projections

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;
Projections of Regular Solids
Inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale.

UNIT-III

Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT-IV

Isometric Projections covering

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

UNIT-V

Overview of Computer Graphics

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Suggested Text/Reference Books:

(i) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
(ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
(iii) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
(iv) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
(v) (Corresponding set of) CAD Software Theory and User Manuals

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

- To execute the basics of Engineering Drawing and Orthographic Projections, Sections and Sectional Views of Right Angular Solids, Isometric Projections and basic Computer Graphic skill in further applications of engineering.

SCHEME OF EXAMINATION
B.TECH (FOUR YEAR) DEGREE COURSE
SECOND YEAR, ELECTRONICS & COMMUNICATION ENGINEERING
SCHOOL OF ENGINEERING & TECHNOLOGY, GGVV BILASPUR (CG) 495009

SEMESTER III (SECOND YEAR)
EFFECTIVE FROM SESSION 2021-22

Sr. No.	Course Code	Course Title	L	T	P	Periods/ week	Evaluation Scheme			Credit
							IA	ESE	Total	
Theory										
1	EC03TPC01	Electronic Devices	3	0	0	3	30	70	100	**3**
2	EC03TPC02	Digital System Design	3	0	0	3	30	70	100	**3**
3	EC03TPC03	Signals and Systems	3	0	0	3	30	70	100	**3**
4	EC03TPC04	Network Theory	3	0	0	3	30	70	100	**3**
5	EC03TBS05	Mathematics-III	3	1	0	4	30	70	100	**4**
6	EC03THS02	Engineering Economics	3	0	0	3	30	70	100	**3**
7	EC03TMC02	Constitution of India	2	0	0	2	0	0	0	**0**
Practical										
1	EC03PPC01	Electronics Devices Lab	0	0	3	3	30	20	50	**1**
2	EC03PPC02	Digital System Design Lab	0	0	3	3	30	20	50	**1**
									Total Credits	**21**

SEMESTER IV (SECOND YEAR)
EFFECTIVE FROM SESSION 2019-20

Sr. No.	Course Code	Course Title	L	T	P	Periods/ week	Evaluation Scheme			Credit
							IA	ESE	Total	
Theory										
1	EC04TPC05	Analog and Digital Communication	3	1	0	4	30	70	100	**4**
2	EC04TPC06	Analog Circuits	3	0	0	3	30	70	100	**3**
3	EC04TPC07	Microcontrollers	3	0	0	3	30	70	100	**3**
4	EC04TBS06	Numerical Methods	3	1	0	4	30	70	100	**4**
5	EC04TES05	Electronics Measurement & Instrumentation	3	0	0	3	30	70	100	**3**
6	EC04THS03	Effective Technical Communication	3	0	0	3	30	70	100	**3**
Practical										
1	EC04PPC03	Analog and Digital Communication Lab	0	0	2	2	30	20	50	**1**
2	EC04PPC04	Analog Circuits Lab	0	0	2	2	30	20	50	**1**
3	EC04PPC05	Microcontrollers Lab	0	0	2	2	30	20	50	**1**
									Total Credits	**23**

L : LECTURE T: TUTORIAL P: PRACTICALIA: INTERNAL ASSESSMENT ESE: END SEMESTER EXAM

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC03TPC01	3	0	0	3 hours	30	70	3

ELECTRONIC DEVICES

Course Objectives:

Students will try to learn:

1. To understand operation of semiconductor devices.
2. To understand DC analysis and AC models of semiconductor devices.
3. To apply concepts for the design of Regulators and Amplifiers
4. To verify the theoretical concepts through laboratory and simulation experiments.
5. To implement mini projects based on concept of electronics circuit concepts.

UNIT-I :Semiconductor concept: Metals, Insulators and Semiconductors, Electrical properties of Ge and Si, Conductivity Equation, Mobility and Conductivity, Electron and holes in intrinsic and extrinsic semiconductors, Donor and Acceptor Impurities,

Electrons in periodic Lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon, Transport Phenomena of semiconductor, Generation and recombination of carriers, Charge density in Semiconductor, Hall Effect, Injected minority charge carriers, Potential variation within graded semiconductor.

Junction Diode Characteristics: Properties of P-N junction, Open circuited P-N junction, V-I characteristics, Temperature dependence of V-I characteristics, Diode resistance, Current component of PN diode**:** Space charge capacitance, Charge control description of a diode, Diffusion capacitance, Junction diode switching times, Breakdown mechanism.

UNIT-II :Diode Circuits: Load line concepts, Graphical analysis, Clipper circuit, Clamper, Comparator, Rectifier, Full wave circuits, Filter circuits: Inductor filter, Capacitor filter, LC filter, Multiple LC filter, CLC or π filter, Zener diode regulator circuit.

OTHER DIODES: Negative conductance in semiconductors- Tunnel diode, Photo diode - Photo voltaic effect, Solar cells, Schottky Diode, Varactor Diode, Avalanche diode, PIN diode, LED, LASER.

UNIT-III :Transistor Characteristics: Junction Transistor, Transistor current components, Transistor as an amplifier, Transistor construction, Transistor circuit configuration (CB, CE, CC)- Analytical Expression for transistor characteristics and Operation, Early Effect, Ebers-Moll Model, β-re model, Transistor as a switch.

Transistor Biasing and Thermal Stabilization: The operating point, Bias stability, Stability factor-Stabilization against variation in I_{CO}, V_{BE} and β, Emitter bias, Collector – to – base bias, Voltage divider bias with emitter bias, Emitter bypass capacitor. Bias compensation.

UNIT-IV: Field Effect Transistor (FET): JFET Construction, Operation, V-I characteristics, Transfer characteristics, Drain characteristics. Metal Oxide Semiconductor Field Effect Transistor (MOSFET)-Construction, Operation and characteristics, Depletion MOSFET, Enhancement MOSFET,

complementary MOSFET.MOS capacitor, C-V characteristics, MOSFET, small signal models of MOS transistor, LED, photodiode and solar cell;

UNIT-V:IC Fabrication: Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

Text/Reference Books:

1. G. Streetman, and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition,Pearson,2014.
2. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
3. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley&Sons, 2006.
4. C.T. Sah, “Fundamentals of solid state electronics,” World Scientific Publishing Co. Inc,1991.
5. Y. Tsividis and M. Colin, “Operation and Modeling of the MOS Transistor,” OxfordUniv.Press, 2011.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the principles of semiconductor Physics
2. Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC03TPC02	3	0	0	3 hours	30	70	3

DIGITAL SYSTEM DESIGN

Course Objectives:

Students will try to learn:

1. To understand number representation and conversion between different representation in digital electronic circuits.
2. To analyze logic processes and implement logical operations using combinational logic circuits.
3. To understand characteristics of memory and their classification.
4. To understand concepts of sequential circuits and to analyze sequential systems in terms of state machines.
5. To understand concept of Programmable Devices, PLA, PAL, CPLD and FPGA and implement digital system using VHDL.
6. To implement combinational and sequential circuits using VHDL.

UNIT-I : Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De-Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.

UNIT-II:MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel Shifter and ALU.

UNIT-III : Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorothmic State Machine Charts, Designing Finite synchronous circuits like Pulse train generator, PseudoRandom Binary Sequence generator, Clock generation

UNIT-IV : Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable Logic Devices like FPGA, Logic implementation using Programmable devices.

UNIT-V :VLSI Design flow: Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis & Simulation , VHDL constructs and codes for combinational and sequential circuits.

Text/Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition ,2006.
4. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
5. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd edition2012.

Course outcomes:

At the end of this course students will demonstrate the ability to

1. Design and analyze combinational logic circuits
2. Design & analyze modular combinational circuits with MUX/DEMUX, Decoderand Encoder.
3. Design & analyze synchronous sequential logic circuits
4. Use HDL & appropriate EDA tools for digital logic design and simulation.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC03TPC03	3	0	0	3 hours	30	70	3

SIGNALS & SYSTEMS

Course Objectives:

Students will try to learn:

1. To introduce students the concept and theory of signals and systems needed in electronics and telecommunication engineering fields.
2. To introduce students to the basic idea of signal and system analysis and its characterization in time and frequency domain

UNIT-I: Signals and systems as seen in everyday life, and in various branches of engineering and science. Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity additivity and homogeneity, shift-invariance, causality, stability, realizability.

UNIT-II: Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations.

UNIT-III : Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem: The idea of signal space and orthogonal bases.

UNIT-IV : The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis.

UNIT-V: State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and it seffects. Relation between continuous and discrete time systems.

Text/Reference books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall,1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill InternationalEdition: c1999.

6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley andSons, 1995.
8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB",TMH, 2003.
9. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi,2001.
10. Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ ColePublishing Company (An international Thomson Publishing Company), 1999.

Course outcomes:

At the end of this course students will demonstrate the ability to

1. Analyze different types of signal
2. Represent continuous and discrete systems in time and frequency domain using differenttransforms
3. Investigate whether the system is stable
4. Sampling and reconstruction of a signal

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC03TPC04	3	0	0	3 hours	30	70	3

NETWORK THEORY

Course Objectives:

Students will try to learn:

1. To explain the basic concepts and laws of DC and AC electrical networks and solve them using mesh and nodal analysis techniques.
2. To introduce students with the fundamental concepts in graph theory.
3. To analyze circuits in time and frequency domain.
4. To explain concepts of driving point and transfer functions, poles and zeroes of network functions.
5. To introduce open circuit, short circuit, transmission, hybrid parameters and their interrelationship.

UNIT-I: Node and Mesh Analysis, matrix approach of network containing voltage and current sources and reactances, source transformation and duality. Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC. circuits.

UNIT-II: Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.

UNIT-III: Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

UNIT-IV: Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations.

UNIT-V: Convolution theorem and Two four port network and interconnections, Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.

Text/Reference Books

1. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000
2. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill NewDelhi, 1994
3. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Appreciate electrical network theorems.
3. Apply Laplace Transform for steady state and transient analysis.
4. Determine different network functions.
5. Appreciate the frequency domain techniques.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC03TBS05	3	1	0	4 hours	30	70	4

MATHEMATICS – III

Course Objectives:

Students will try to learn:

1. To expand the given periodic function defined in the given range in terms of sine and cosine multiple of terms as a Fourier series.
2. To extremise the functional using integration technique.
3. To form and solve the partial differential equation using different analytical techniques.

UNIT – I : Functions of Complex Variables-Differentiation: Limit, Derivative, Analytic function, Cauchy-Riemann Equations, Harmonic Functions, finding harmonic conjugate, Elementary analytic functions (exponential, trigonometric, logarithmic) and their properties, Conformal mapping, Mobius transformation and their properties.

UNIT – II : Functions of Complex Variables- Integration: Complex Integration, Cauchy´s integral theorem, and Integral formula, Liouville's theorem and Maximum- Modulus theorem (without proof),Taylor´s & Laurent´s series, Singular point, Poles & resides, Residue theorem & its application to contour integration.

UNIT – III : Laplace Transform: Definition, Linearity, Shifting & Scaling properties, Transform of Elementary functions, Transform of Derivatives & Integrals, Multiplication by t &division by t, Inverse Laplace transform, Convolution theorem, Transform of Periodic functions, Unit Step function & Dirac delta function, Initial value and Final value theorems, Application to solution of ordinary differential equations.

UNIT – IV : Fourier Transform: Definition of Fourier Integrals- Fourier Sine & Cosine integrals, Complex form of Fourier integral, Fourier Sine & Cosine transforms, Complex form of Fourier Transform, Linearity, Shifting & Scaling properties, Modulation theorem, Inverse Fourier transform, Fourier transform of derivatives.

UNIT – V : Differential Equations: First order ordinary differential equations-Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type, Second order linear differential equations with constant coefficient.

SUGGESTED BOOKS & REFERENCE:-

1. H K Das, "Advance Engg. Mathematics", S-Chand Publication
2. B S Grewal, "Higher Engg. Mathematics", Khanna Publication
3. Erwin Kreyszig, "Advance Engg. Mathematics", J Willey & Sons
4. Louis A Pipes, "Applied Mathematics for Engineers & Physicists", TMH
5. S.L .Ross, Differential Equations, 3rd Ed., Wiley India,2009.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Apply knowledge of complex variables, Laplace transform, Fourier transform and Differential equations for understanding and solving engineering Problems

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC03THS02	3	0	0	3 hours	30	70	3

ENGINEERING ECONOMICS

Course Objectives:

Students will try to learn:

1. To Analyze Cost/Revenue Data And Carry Out Make Economic Analyses In The Decision Making Process
2. To Justify or Reject Alternatives/Projects On An Economic Basis.

UNIT - I: Basic Concepts and Definitions, Methodology of Economics, Demand and Supply – elasticity, Theory of the Firm and Market Structure, Price and output determinations in different types of market

UNIT - II: Public Sector Economics –Welfare economics, Central and commercial marks and their functions, Industrial policies, theory of localization, weber & surgent Florence theory, investment analysis-NPV, ROI, IRR, Payback period, SWOT analysis.

UNIT – III: Monetary and Fiscal Policy; Tools, impact on the economy, Inflation, Business Cycle, Cash Flow-2,3,4 Model.

UNIT – IV: Business Forecasting – Elementary techniques. Cost and Revenue Analysis, Capital Budget, Break Even Analysis.

UNIT – V: Indian economy; Urbanization, Unemployment–Poverty, Regional Disparities, Unorganized Sectors- Roll of Plans, Reforms-Post Independent period.

Text Books:

1. Mankiw Gregory N.(2002), Principles of Economics, Thompson Asia
2. V. Mote, S. Paul, G. Gupta(2004), Managerial Economics, Tata McGraw Hill
3. Misra, S.K. and Puri (2009), Indian Economy, Himalaya
4. Pareek Saroj (2003), Textbook of Business Economics, Sunrise Publishers

Recommended Books:

1. Kapila U. Indian economy since Independence. Academic Foundation, New Delhi
2. Misra, S. K. and Puri V. K. Indian Economy — Its Development Experience. Himalaya 3.Publishing House, Mumbai
3. Dutt R. and Sundharam K. P. M. Indian Economy. S. Chand & Company Ltd., New Delhi.
4. Mathur R. Indian Economic Policy and Reform. RBSA Publisher, Jaipur

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Aware of the basic theoretical framework underlying the field of Microeconomics, Macroeconomics, Indian Economy, Public Finance etc.
2. Understand the operations of money and banking and their interaction with the rest of the economy

3. Realize how monetary forces operate through a multitude of channels — market, non-market, institutions and among others.
4. Have an understanding of the various issues/components of the Indian economy so that they are able to comprehend and critically appraise current Indian economic problems.
5. Understand the major developments in the Indian economy before Independence, at the time of Independence and during the post-Independence period.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC03TMC02	2	0	0	2 hours	0	0	0

CONSTITUTION OF INDIA

Course Objectives:

Students will try to learn:

1. To understand the need for a constitution.
2. To explain the role of constitution in a democratic society.
3. To list the key features of the constitution.
4. To appreciate the fundamental rights of the citizens of India.

UNIT – I: Introduction: Constitution – Meaning of the term, Sources and Constitutional history, Features, Citizenship, Preamble.

UNIT-II: Fundamental Rights & Duties: Fundamental Rights & Duties, Directive Principles of State Policy.

UNIT-III: Union Government: Structure of the Indian Union: Federalism, Centre-State relationship, President : Role, Power and Position, PM and Council of ministers, Cabinet & Central Secretiat, Lok Sabha, Rajya Sabha.

UNIT-IV: State Government: Governor: Role & Position, CM and Council of ministers, State Secretariat: Organisation Structure & Functions.

UNIT-V: Relation between Centre &States: Distribution of Legislative Powers, Administrative relations, Coordination between States.

Text /Reference Books:

1. V. N. Shukla; “Constitution of India”
2. J.N.Pandey; “Constitutional Law of India”
3. M. P. Jain; “Indian Constitutional Law”

Course Outcomes:

At the end of this course students will demonstrate the ability:

1. To enhance their knowledge about society and public welfare.
2. To become a responsible citizen and give an active & positive support in Indian democracy
3. Students will understand the importance of their duties towards the society and nation and be aware about their rights for their overall development

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC04TPC05	3	1	0	4 hours	30	70	4

ANALOG AND DIGITAL COMMUNICATION

Course Objectives:

Students will try to learn:

1. The fundamentals of basic communication system, types of noise affecting communication system and noise parameters.
2. Need of modulation, modulation processes and different amplitude modulation schemes
3. Different angle modulation schemes with different generation and detection methods.
4. Various radio receivers with their parameters.
5. Need of sampling and different sampling techniques.
6. Generation and detection of pulse modulation techniques and multiplexing.
7. About theoretical bounds on the rates of digital communication system and represent a digital signal using several modulation methods

UNIT-I: Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

UNIT-II: Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De- emphasis, Threshold effect in angle modulation.

UNIT-III: Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

UNIT-IV: Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Base band Pulse Transmission- Inter symbol Interference and Nyquist criterion. Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.

UNIT-V: Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.

Text/ReferenceBooks:

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M. ;Communication Systems Engineering", Pearson Education,2002.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill,2001.

4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering'',JohnWiley, 1965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication'', KluwerAcademic Publishers, 2004.
6. Proakis J.G., ``Digital Communications'', 4th Edition, McGraw Hill, 2000.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth
2. Analyze the behavior of a communication system in presence of noise
3. Investigate pulsed modulation system and analyze their system performance
4. Analyze different digital modulation schemes and can compute the bit error performance

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC04TPC06	3	0	0	3 hours	30	70	3

ANALOG CIRCUITS

Course Objectives:

Students will try to learn:

1. To understand the operation of the various bias circuits of MOSFET and Analyze and design MOSFET bias circuits.
2. To understand the operation and design of multistage. amplifier for a given specification.
3. To understand the operation and design of transformer coupled various types of power amplifier circuits.
4. To understand the effects of negative feedback on amplifier circuits.
5. To analyze the different RC and LC oscillator circuits to.
6. To determine the frequency of oscillation

UNIT-I: Diode Circuits, Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

UNIT-II: High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.

UNIT-III: Oscillators: Review of the basic concept, Barkhausen criterion, RC Oscillators (Phase shift, Wein Bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), Non sinusoidal oscillators, Current mirror: Basic topology and its variants, V-I Characteristics, Output resistance and minimum sustainable voltage (VON), maximum usable load.

UNIT-IV: Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OP-AMP Design: design of differential amplifier for a given specification. Design of gain stages and output stages, compensation. OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, Precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop design guidelines.

UNIT-V: Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. Analog to-digital converters (ADC): Single Slope, dual slope, successive approximation, flash etc. Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.

Text/Reference Books:

1. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College11Publishing, Edition IV
5. Paul R. Gray and Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the characteristics of diodes and transistors
2. Design and analyze various rectifier and amplifier circuits
3. Design sinusoidal and non-sinusoidal oscillators
4. Understand the functioning of OP-AMP and design OP-AMP based circuits
5. Design ADC and DAC

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC04TPC07	3	0	0	3 hours	30	70	3

MICROCONTROLLERS

Course Objectives:

Students will try to learn:

1. To develop background knowledge and core expertise of microcontroller.
2. To know the importance of different peripheral devices and their interfacing to microcontrollers.
3. To know the design aspects of microcontrollers.
4. To write assembly language programs of microcontrollers for various applications.

UNIT-I: Overview of microcomputer systems and their building blocks, types of microprocessor, Multiplexing concept of buses, buffer.

UNIT-II: Introduction to 8085, bus architecture, pin diagram, demultiplexing of buses, Instruction set of 8085.

UNIT-III: Stack, stack related instructions, concept of interrupts, Direct memory access, Memory interfacing.

UNIT-IV : Interfacing with peripherals - timer, serial I/O, parallel I/O, A/D and D/A converters; Arithmetic Coprocessors; System level interfacing design; Concepts of virtual memory, Cache memory,

UNIT-V: Advanced coprocessor Architectures- 8086, 286, 486, Pentium; Microcontrollers: 8051 systems, Introduction to RISC processors; ARM microcontrollers interface designs.

Text/Reference Books:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996
2. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers.
3. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.
4. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Do assembly language programming
2. Do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.
3. Develop systems using different microcontrollers
4. Understand RSIC processors and design ARM microcontroller based systems

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC04TBS06	3	1	0	4 hours	30	70	4

NUMERICAL METHODS

Course Objectives:

Students will try to learn:

1. To understand the method of solving algebraic, transcendental equations.
2. To determine the approximate value of the derivative & definite integral for a given data using numerical techniques.

UNIT- I : Introduction of Errors and their Analysis, types of errors, numerical problems on error analysis, curve fitting: method of least squares, fitting of exponential curves$y = ae^{bS}$, fitting of the curve$y = ab^{S}$, fitting of the curve$y = ax^{b}$.Method of moments

UNIT- II: Numerical Solution of Algebraic and Transcendental Equations: Graphical method bisection Method, Secant Method, Regula-falsi Method, Newton Raphson Method, Solution of a system of simultaneous linear algebraic Equations Direct methods: Gauss elimination Method, Gauss Jordan method, Iterative methods .Jacobi Iterative Method, Gauss Seidel Iterative method.

UNIT- III : The Calculus of Finite Differences: Finite differences, Difference formula, operators and relation between operators. Inverse Operator, Interpolation with equal intervals: - Newton's forward and backward interpolation formula. Interpolation with Unequal intervals: - Lagrange's interpolation Newton's difference formula, inverse interpolation.

UNIT- IV : Numerical Differentiation and Integration: - Numerical Differentiation Newton's forward and Backward difference interpolation formula. Maxima and Minima of aTabulated function, Numerical Integration :-Trapezoidol rule, simpson's (1/3) rd and (3/8) th rule, Boole's rule, weddle rule.
Difference Equations: Definition ,order and degree of a difference equation, Linear difference equations, Difference equations reducible to Linear form, simultaneous difference equations with constant coefficients.

UNIT- V : Numerical solution of ordinary differential equation : Taylor series method, Euler's method, Modified Euler method Runge's method Runge-Kutta method, numerical method for solution of partial differential equations. General linear partial differential equation. Laplace equation and Poisson equation.

Books Recommended:

1. JAIN & IYNGAR Numerical Methods for Scientific and Engineering Computations.
2. RAO G.S. Numerical Anlysis.
3. Grewal B S Numerical Methods In Engineering and Science.
4. Das K K Advance Engineering Methods.
5. Rajaraman V Computer Oriented Numerical Methods
6. P. Kandasamy K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
7. S. S. Sastry, Introduction methods of Numerical Analysis, PHI, 4th Edition, 2005.

8. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Apply knowledge of numerical analysis for understanding, formulating and solving engineering Problems

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC04TES05	3	0	0	3 hours	30	70	3

ELECTRONICS MEASUREMENT & INSTRUMENTATION

Course Objectives:

Students will try to learn:

1. To explain basic concepts and definitions in measurement.
2. To describe the bridge configurations and their applications.
3. To elaborate discussion about the importance of signal generators and analyzers in Measurement.

UNIT – I: Measurements and Measurement system: Measurements, Significance of measurement, Methods of measurement- Direct and Indirect Method. Instruments and measurement system: Mechanical, Electrical, Electronic instruments; Classification of Instruments: Deflection and null type instruments. Analog and Digital mode of Operation, Application of measurement system, Characteristics of instrument and measurement system: static & dynamic; Elements of a Generalized Measurement System: Primary Sensing Element, Variable Conversion Element, Data presentation Element. Accuracy and precision, Significant figure, types of error, gross error, systematic error- Instrumental, Environmental, Observational Errors, Random error, Probability of error, Probable Error- of a finite number of readings, for combination of components, Limiting error.

UNIT –II: Electromechanical Indicating Instruments: Operating forces, Constructional Details, Types of Support, Torque/Weight Ratio, Control system, Damping- Air friction and Eddy current damping.
D´Arsonaval Galvanometer- construction, Torque Equation, Dynamic Behavior, Undamped, Damped, Overdamped Motion, Response of Galvanometer. Ballistic Galvanometer. PMMC- Construction, Torque Equation, Voltage/Current Measurement: Ammeter, Voltmeter, Ohmmeter, Multimeter (V.O.M.), Ratiometer, Megger. High frequency Measurement: Q-meter

UNIT – III: AC Bridge: Introduction, Sources and Detectors, General equation for bridge balance, General form of AC Bridge. Maxwell´s Bridge, Hay´s bridge, Anderson´s bridge, De-Sauty´s bridge, Schering bridge, Wien´s bridge. **Electronic Instruments:** Introduction, Advantage of Electronic voltmeter, VTVM, Differential voltmeter, Electronic voltmeter using rectifier, True RMS reading voltmeter, Calorimeter power meter.

UNIT – IV: Transducers: Classification of transducer, Primary & Secondary, Passive & Active, Analog & Digital, Potentiometer, loading effect, Strain Gauge, Thermistor, Construction of thermistor, Thermocouple, LVDT, Advantage & Disadvantage of LVDT, RVDT, Capacitive Transducer, Piezo-electric transducer, Hall-effect Transducer, Capacitive Transducer, Pressure Transducer.

UNIT – V: Display devices: Digital display method, Segmental display- 7segment & 14 segment display, dot matrix, LED, LCD, TFT, Plasma display, DLP. **Digital voltmeter (DVM):** Types of DVM, Ramp type DVM, Integrating type DVM, Potentiometer type (non-integration type). **Recorders:** Analog Recorder, Null type Recorder, Single point Recorder, Graphical strip chart, X-Y recorders, Magnetic tape recorder, FM recorder.**CRO:** Introduction, Oscilloscope block diagram, CRT, Functional block diagram of sampling, Storage, Dual trace and dual beam oscilloscope.

SUGGESTED BOOKS & REFERENCE:-

1. Modern Electronic Instrumentation and Measurement Technique, W D Cooper & A D Helfrick, PHI 2000
2. A Course in Electrical and Electronic Measurements and Instrumentation, A K Sawhney, Dhanpat Rai & Sons, 2010

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Measure low, medium & high resistances using suitable bridges.
2. Determine the value of inductor & Capacitor with the help of AC Bridges.
3. Test & Calibrate ammeter, voltmeter and wattmeter.
4. Understand the principles of various electronic instruments and transducers.
5. Measure frequency and phase in CRO.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC04THS03	3	0	0	3 hours	30	70	3

EFFECTIVE TECHNICAL COMMUNICATION

Course Objectives:

Students will try to learn:

1. To participate actively in writing activities (individually and in collaboration)
2. To understand how to apply technical information and knowledge in practical documents
3. To practice the unique qualities of professional writing style, including sentence conciseness, readability, clarity, accuracy, honesty, avoiding wordiness or ambiguity, previewing.
4. To recognize, explain, and use the genres of technical communication: technical abstracts, data based research reports, instructional manuals, technical descriptions, and web pages
5. To recognize and develop professional format features in print, html, and multimedia modes, as well as use appropriate nonverbal cues and visual aids.

UNIT-I: Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

UNIT-II: Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

UNIT-III: Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity

UNIT-IV: Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

UNIT-V: Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

Text/Reference Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey, NewYork, 2004.
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.

5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN:07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

Course Outcomes:

1. At the end of the semester employability skill of students will get developed
2. Students will get improved their technical vocabulary & their accent.
3. Students will understand about technical communication strategies and personality skills.
4. Students will be able to write various technical scripts/letters.

SCHEME OF EXAMINATION
B.TECH (FOUR YEAR) DEGREE COURSE
THIRD YEAR, ELECTRONICS & COMMUNICATION ENGINEERING
SCHOOL OF ENGINEERING & TECHNOLOGY, GGVV BILASPUR (CG) 495009
EFFECTIVE FROM SESSION 2021-22
SEMESTER V (THIRD YEAR)

Sr. No.	Course Code	Course Title	L	T	P	Periods/ week	Evaluation Scheme			Credit
							IA	ESE	Total	
Theory										
1	EC05TPC08	Electromagnetic Waves	3	1	0	4	30	70	100	**4**
2	EC05TPC09	Computer Network	3	0	0	3	30	70	100	**3**
3	EC05TPC10	LIC and its Application	3	0	0	3	30	70	100	**3**
4	EC05TPC11	Control Systems	3	1	0	4	30	70	100	**4**
5	EC05TPE01 EC05TPE02 EC05TPE03 EC05TPE04	Program Elective – 1 • Information Theory & Coding • CMOS Design • Introduction to MEMS • Computer Architecture	3	0	0	3	30	70	100	**3**
6	EC05TOE01 EC05TOE02	Open Elective-1 • Data Structure & Algorithms • Operating Systems	3	0	0	3	30	70	100	**3**
Practical										
1	EC05PPC06	Electromagnetic Waves Lab	0	0	2	2	30	20	50	**1**
2	EC05PPC07	Computer Networks Lab	0	0	2	2	30	20	50	**1**
3	EC05PPC08	LIC and its Application Lab	0	0	2	2	30	20	50	**1**
									Total Credits	**23**

SEMESTER VI (THIRD YEAR)

Sr. No.	Course Code	Course Title	L	T	P	Periods/ week	Evaluation Scheme			Credit
							IA	ESE	Total	
Theory										
1	EC06TPC12	Digital Signal Processing	3	1	0	4	30	70	100	**4**
2	EC06TPC13	Probability Theory and Stochastic Processes	3	0	0	3	30	70	100	**3**
3	EC06TPE05 EC06TPE06 EC06TPE07 EC06TPE08	Program Elective – 2 • Antenna & Wave Propagation • Power Electronics • High Speed Devices & Circuits • Nanoelectronics	3	1	0	4	30	70	100	**4**
4	EC06TOE03 EC06TOE04	Open Elective-2 • Cryptography & Network Security • Artificial Intelligence	3	0	0	3	30	70	100	**3**
5	EC06TBS07	Life Science	3	0	0	3	30	70	100	**3**
Practical										
1	EC06PPC09	Digital Signal Processing Lab	0	0	2	2	30	20	50	**1**
2	EC06PPC10	Electronic Measurement Lab	0	0	2	2	30	20	50	**1**
3	EC06PPC11	Mini Project/Electronic Design workshop	0	0	4	4	30	20	50	**2**
									Total Credits	**21**

L : LECTURE T: TUTORIAL P: PRACTICALIA: INTERNAL ASSESSMENT ESE: END SEMESTER EXAM

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPC08	3	1	0	4 hours	30	70	4

ELECTROMAGNETIC WAVES

Course Objectives:

- To understand the concepts, working principles and laws of Electromagnetic Waves.
- To perform analysis of uniform plane wave and waveguides.
- To understand the basic concept of radiation and antenna.

Unit I: Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, reflection coefficient and VSWR, Impedance Transformation on Loss- less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

Unit II: Maxwell‟s Equations- Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface.

Unit III: Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wave polarization, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor, Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

Unit IV: Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Unit V: Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna

Text/Reference Books:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
4. David Cheng, Electromagnetics, Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- Understand characteristics and wave propagation on high frequency transmission lines
- Carryout impedance transformation on TL
- Use sections of transmission line sections for realizing circuit elements
- Characterize uniform plane wave
- Calculate reflection and transmission of waves at media interface
- Analyze wave propagation on metallic waveguides in modal form
- Understand principle of radiation and radiation characteristics of an antenna

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPC09	3	0	0	3 hours	30	70	3

COMPUTER NETWORK

Course Objectives:

Student will try to learn to:

- Build an understanding of the fundamental concepts of computer networking.
- Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
- Develop an understanding of modern network architectures from a design and performance perspective.

Unit I: Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

Unit II: Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical.

Unit III: Multiplexing. Transport layer: Connectionless transport - User Datagram Protocol, Connection oriented transport – Transmission Control Protocol, Remote Procedure Call. Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call. Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.

Unit IV: Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing

Unit V: Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.

Text Reference books:

1. William Stallings, “Data and computer communications”, Prentice Hall
2. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition
3. J.F. Kurose and K. W. Ross, “Computer Networking – A top down approach featuring the Internet”, Pearson Education, 5th Edition
4. L. Peterson and B. Davie, “Computer Networks – A Systems Approach” Elsevier Morgan Kaufmann Publisher, 5th Edition.
5. T. Viswanathan, “Telecommunication Switching System and Networks”, Prentice Hall
6. S. Keshav, “An Engineering Approach to Computer Networking” , Pearson Education
7. Andrew Tanenbaum, “Computer networks”, Prentice Hall
8. D. Comer, “Computer Networks and Internet/TCP-IP”, Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- Understand the concepts of networking thoroughly.
- Design a network for a particular application.
- Analyze the performance of the network.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPC10	3	0	0	3 hours	30	70	3

LIC AND IT'S APPLICATIONS

Course objective:

The students will be able to learn:

- To understand the concepts, working principles and key applications of linear integrated circuits.
- To perform analysis of circuits based on linear integrated circuits
- To design circuits and systems for particular applications using linear integrated circuits.

UNIT I Basic Building Blocks for ICs & OPAMP: Basic Differential Amplifiers & Analysis, Introduction to OPAMP, Ideal OPAMP Characteristics, OPAMP ICs:741Pin Diagram and Pin Function, Inverting Amplifier, Non-Inverting Amplifier, Definition of OPAMP Parameters, Frequency Response of OPAMP, Open Loop & Closed Loop Configuration of OPAMP and its Comparisons, Voltage Comparator, Zero Crossing Detector, Level Detector.

UNIT II Applications of OPAMP: Introduction, Adder, Substractor/Difference Amplifier, Voltage Follower, Integrator, Differentiator, Comparator IC such as LM339, Window detector, Current to Voltage and Voltage to Current Converter, Instrumentation Amplifier, Precision Half Wave Rectifier, Precision Full Wave Rectifier, Log & antilog amplifier, Schmitt Trigger, Bridge Amplifier, Peak Detectors/Peak follower, Sampleand- Hold Amplifiers, Square wave generator, Saw-tooth wave generator, Triangular wave generator, Astable multivibrator, Monostable multivibrator, Dead Zone circuit- with positive output, with negative output, Precision clipper circuit, Generalized Impedance Converter (GIC) and its application.

Frequency response of OPAMP: Open loop voltage gain as a function of frequency, Unity gain Bandwidth, Close loop frequency response, Slew Rate.

UNIT III Active filters & PLL: - Introduction to Filters, Merits & Demerits of active filters of over Passive Filter, Classification of filters, Response characteristics of Filter, First Order and Second Order active high pass, Low pass, Band pass and band reject Butterworth filters.

Phase Lock Loop: Operating Principle of the PLL, Linear Model of Phase Lock Loop, Lock Range and Capture Range, Application of the PLL. Voltage Controlled Oscillator(VCO).

UNIT IV D/A and A/D converters & Analog Multiplier: D/A converter - Ladder, R-2R, A/D converters Ramp, Continuous conversion, Flash ADC, Dual slope ADC, Successive Approximation, Voltage to Time converters. Timing and circuits comparisons, DAC/ADC specifications.

Analog Multiplier: Basic Analog Multiplication Techniques, Applications of Multiplier-Frequency doubling, Phase-angle difference detection, Voltage dividing action, Square root of a

signal, Function realization by Multiplier, Amplitude Modulator, Standard Modulator Circuit, Demodulation of AM signal.

UNIT V Timer & Regulators: Monolithic 555 Timer: Functional Diagram: Monostable and Astable operation using 555 Timer. Voltage Regulators: Basic Configurations Parameters for Voltage Regulators, Basic blocks of linear IC voltage regulators, Positive and negative voltage regulators, Positive and negative voltage regulators, General Purpose IC Regulator (723): Important features and Internal Structure, Switching regulators.

Text & Reference books:-

1. "Op - Amps and Linear Integrated Circuits", Ramakant A. Gayakwad, PHI
2. "Operational Amplifiers and Linear Integrated Circuits", Robert. F. Coughlin & Fred.F. Driscoll, PHI/Pearson.
3. "Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain, New Age International
4. " Integrated Circuits" by K. R. Botkar, Khanna Publications
5. "Design with Operational Amplifiers and Analog Integrated Circuits", Sergio Franco, TMH
6. Microelectronic Circuits: Theory and Applications (International Version), OXFORD University Press

Course Outcomes:

After the completion of this course student will

- Understand the fundamentals and areas of applications for the integrated circuits.
- Analyze important types of integrated circuits.
- Demonstrate the ability to design practical circuits that perform the desired operations.
- Understand the differences between theoretical, practical & simulated results in integrated circuits.
- Select the appropriate integrated circuit modules to build a given application

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPC11	3	1	0	4 hours	30	70	4

CONTROL SYSTEMS

Course Objectives:

The students will be able to learn:

- The type of System, dynamics of physical systems, classification of control system, analysis and design objective.
- How to represent system by transfer function and block diagram reduction method and Mason‟s gain formula.
- Time response analysis and demonstrate their knowledge to frequency response.
- Stability analysis of system using Root locus, bode plot, polar plot, and Nyquist plot.

Unit I: Introduction to control problem- Industrial Control examples. Transfer function. Block diagram and signal flow graph analysis. Open & Closed-loop systems, Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tacho-generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators.

Unit II: Time response of second-order systems, steady-state errors and error constants. Performance specifications in time-domain, proportional, integral and derivative systems. Feed forward and multi-loop control configurations,

Unit III: Feedback control systems- Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness. stability concept, relative stability, Routh stability criterion. Root locus method of design. Lead and lag compensation.

Unit IV: Frequency-response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Performance specifications in frequency-domain. Frequency domain methods of design, Compensation & their realization in time & frequency domain. Lead and Lag compensation.

Unit V : State variable Analysis- Concepts of state, state variable, state model, state models for linear continuous time functions, diagonalization of transfer function, solution of state equations, concept controllability & observability. Introduction to Optimal control & Nonlinear control, Optimal Control problem, Regulator problem, Output regulator, tracking problem. Nonlinear system – Basic concept & analysis.

Text/Reference Books:

1. Gopal. M., “Control Systems: Principles and Design”, Tata McGraw-Hill, 1997.
2. Kuo, B.C., “Automatic Control System”, Prentice Hall, sixth edition, 1993.
3. Ogata, K., “Modern Control Engineering”, Prentice Hall, second edition, 1991.
4. Nagrath & Gopal, “Modern Control Engineering”, New Age International, New Delhi

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- Characterize a system and find its study state behavior
- Investigate stability of a system using different tests
- Design various controllers
- Solve liner, non-liner and optimal control problem

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPE01	3	0	0	3 hours	30	70	3

INFORMATION THEORY & CODING

Course Objectives:

- Design the channel performance using Information theory.
- Comprehend various error control code properties.
- Apply linear block codes for error detection and correction.
- Apply convolution codes for performance analysis & cyclic codes for error detection and correction.
- Apply Turbo coding and decoding for error detection and correction.

Unit I: Source Coding: Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and entropy, Information Measures for continuous Random Variables, Source Coding Theorem, Huffman coding.

Unit II: Channel Capacity Coding: Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem, Shannon Limit, Markov sources.

Unit III: Error Control Coding (Channel Coding) Linear Block Codes for Error Correction & Cyclic Codes: Introduction to Error Correcting Codes, Basic Definitions, Matrix Description of Linear Block Codes, Equivalent Codes, Parity Check Matrix, Decoding of a Linear Block Code, Syndrome Decoding, Hamming Codes. **Cyclic Codes:** Polynomials, The Division algorithm for Polynomials, A Method for Generating Cyclic codes, Matrix Description of cyclic codes, Burst Error Correction.

Unit IV: Convolution Codes: Introduction to Convolution Codes, Tree codes and Trellis Codes, Polynomial Description of Convolution Codes (analytical Representation), distance Notions for Convolution Codes, The Generating Function, Matrix Description of Convolution Codes, Viterbi Decoding, Distance Bounds for Convolution Codes.

Unit V: Turbo Codes: Turbo codes, Turbo decoding, Distance properties of turbo codes, Convergence of turbo codes

Text/Reference Books:

1. Simon Haykin, Digital Communications, Wiley India Edition, 2009
2. N. Abramson, Information and Coding, McGraw Hill, 1963.
3. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
4. R.B. Ash, Information Theory, Prentice Hall, 1970.
5. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.
6. Todd K. Moon, "Error Correction Coding", 1st Edition, Wiley-Interscience, 2006.
7. F. J. MacWilliams, N. J. A. Sloane, "The Theory of Error-Correcting Codes", North-Holland, Amsterdam, 1977
8. R. E. Blahut, "Algebraic Codes for Data Transmission", 1st Edition, Cambridge University Press 2003.
9. Cary W. Huffman, Vera Pless, "Fundamentals of Error-Correcting Codes", 1st Edition, Cambridge University Press, 2003.
10. Rolf Johannesson and Kamil Sh. Zigangirov, ``Fundamentals of Convolutional Coding"", IEEE Press, 1999.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

- Understand the concept of information and entropy
- Understand Shannon‟s theorem for coding
- Calculation of channel capacity
- Apply coding techniques

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPE02	3	0	0	3 hours	30	70	3

CMOS DESIGN

Course Objectives:

- Impart knowledge of MOS transistor theory and CMOS technologies.
- Impart knowledge on architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology. study of VHDL language

Unit I: FUNDAMENTALS OF MOSFETS: Introduction to MOS transistor, basic operation, threshold voltage ,V-I characteristic ,Depletion MOSFET ,trans conductance, PMOS and its V-I characteristic, aspect ratio and its implication, channel length modulation, substrate bias effect, electrical parameters of MOSFETS.

Unit II: CMOS INVERTER: Introduction, ideal inverter, Logic level standards, VTC of inverter, Noise margin, Basic NMOS inverter, CMOS inverter, design technique, inverter switching characteristic, delay times, transient effects, power dissipation, introduction to bi-CMOS inverter

Unit III: STATIC AND DYNAMIC LOGIC CIRCUITS: Introduction, Various Static CMOS logic gate design ,Pseudo-nMOS gates ,pass transistor logic, transmission gates, tristate buffer, dynamic logic, Evaluate logic, Domino CMOS logic, Non ideal effects of dynamic logic circuits

Unit IV: SEQUENTIAL AND COMBINATIONAL CIRCUITS: Types of regenerative circuits, bi-stability principle, basics S-R flip flop, JK flip-flop, Master slave Flip Flop, D latch, Static Vs Dynamic latch ,memory system, types of semiconductor memory, Dynamic RAM, Static RAM.

Unit V: INTRODUCTION TO VHDL: Introduction and use of VHDL, Entity and Architecture Declaration, Types of Models of Architecture, Data objects, Data types, Operators ,concurrent and sequential statements, process statements, case ,if, when statements ,Design of sequential and combinational circuits.

Text/References books:

1. Douglas A. Pucknell & Kamran Eshraghian "Basic VLSI Design", PHI 3rd Edition.
2. Neil H.E. Weste, David Harris, Ayan Banerjee, "CMOS VLSI Design-A Circuits and Systems Perspective", Pearson Education 3rd Edition.
3. J Bhaskar, "A VHDL Primer", Pearson Publication.
4. Brow and Varsenic "Fundamentals of VLSI Design Techniques with VHDL" MGH Publication.
5. Angsuman Sarkar and Swapandip De, "VLSI design and EDA tools", SCITECH Publication.

Course outcomes:

At the end of this course, students will demonstrate the ability:

- To introduce the concept of VLSI.
- To introduce the concept of MOS fabrication, MOS design and different MOS circuits.
- To introduce the concept of VHDL.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPE03	3	0	0	3 hours	30	70	3

INTRODUCTION TO MEMS

Course Objectives:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

Unit I: Introduction : Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication – Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

Unit II: Sensors and Actuators-I : Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph – Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

Unit III : Sensors And Actuators-II: Piezoresistive sensors – Piezoresistive sensor materials – Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

Unit IV: Micromachining: Silicon Anisotropic Etching-Anisotrophic Wet Etching-Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE)-Isotropic Wet Etching-Gas Phase Etchants – Case studies –Basic surface micro machining processes-Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

Unit V: Polymer and Optical MEMS: Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

Text books:

1. Chang Liu, „Foundations of MEMS“, Pearson Education Inc., 2012.
2. Stephen D Senturia, „Microsystem Design“, Springer Publication, 2000.
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.

Reference books:

1. Nitaigour Premchand Mahalik "MEMS", The McGraw-Hill Companies, 2011.
2. Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
3. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001.
4. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
5. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
6. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the operation of micro devices, micro systems and their applications.
- Design the micro devices, micro systems using the MEMS fabrication process.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPE04	3	0	0	3 hours	30	70	3

COMPUTER ARCHITECTURE

Course Objectives:

- To provide an introduction to concepts in computer architecture.
- Impart knowledge on design aspects, system resources such as memory technology and I/O subsystems needed to achieve increase in performance.
- Acquaint the students with current trends in computing architecture.

Unit I: Processor Basics: CPU Organization, Fundamental and features, Data Representation formats, Fixed and Floating point representation, Instruction Sets, Formats, Types and Programming Considerations.

Unit II: Data path Design: Fixed-Point Arithmetic, Combinational ALU and Sequential ALU, Floating point arithmetic and Advanced topics, Hardware Algorithm – Multiplication, Division.

Unit III: Control Design: Basic Concepts, Hardwired control, Microprogrammed Control, CPU control Unit and Multiplier control Unit, Pipeline Control.

Unit IV: Memory Organization: Memory device characteristics, RAM technology and Serial access memories technology, multilevel memory systems, Address translation and Memory allocation systems, Cache memory.

Unit V: System Organization: Programmed I/O, DMA, Interrupts and IO Processors, Processor-level Parallelism, Multiprocessor and Fault tolerance system.

Text /Reference Books:

1. V. Carl Hammacher, “Computer Organisation”, Fifth Edition.
2. A.S.Tanenbum, “Structured Computer Organisation”, PHI, Third edition
3. Y.Chu, "Computer Organization and Microprogramming”, II, Englewood Chiffs, N.J., Prentice Hall Edition
4. M.M.Mano, “Computer System Architecture”, Edition
5. C.W.Gear, “Computer Organization and Programming”, McGraw Hill, N.V. Edition
6. Hayes J.P, “Computer Architecture and Organization”, PHI, Second edition
7. Computer Organizations and Design- P. Pal Chaudhari, Prentice-Hall of India

Course Outcomes:

At the end of these course students will demonstrate the ability to

- Learn how computers work
- Know basic principles of computer‟s working
- Analyze the performance of computers
- Know how computers are designed and built
- Understand issues affecting modern processors (caches, pipelines etc.).

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TOE01	3	0	0	3 hours	30	70	3

DATA STRUCTURE & ALGORITHMS

Course Objectives:

- Learn Basic Data Structures such as, Linked Lists, Stacks and Queues, Tree and Graph.
- Learn Algorithm for Solving Problems Like Sorting, Searching, Insertion and Deletion of Data
- Understand the Complexity of Various Algorithms.
- Introduce Various Techniques for Representation of the Data in in Memory.

Unit I: Algorithm Analysis and Complexity, Data Structure- Definition, Types of Data Structures Recursion: Definition, Linear and Binary Recursion, Searching Techniques, Linear Search, Binary Search.

Unit II: Sorting Techniques: Basic Concepts, Sorting Algorithms: Insertion (Insertion Sort), Selection (Heap Sort), Exchange (Bubble Sort, Quick Sort), Distribution (Radix Sort) and Merging (Merge Sort) Algorithms.

Unit III: Stacks and Queues: Stacks: Basic Stack Operations, Representation of a Stack Using Arrays, Stack Applications: Reversing List, Factorial Calculation, Infix to Postfix Transformation, Evaluating Arithmetic Expressions.

Queues: Basic Queue Operations, Representation of a Queue Using Array, Implementation of Queue Operations Using Stack. Circular Queues, Priority Queues. Applications of Queues-Round Robin Algorithm,

Unit IV: Linked Lists: Introduction, Single Linked List, Representation of a Linked List in Memory, Operations on a Single Linked List, Circular Linked List, Double Linked List, Advantages and Disadvantages of Linked List.

Unit V: Trees: Terms Related to Tree, Binary Tree, Binary Tree Traversals, Creation of Binary Tree from In-order, Pre-order and Post-Order Traversals. Threaded Binary Trees. Binary Search Tree, BST Operations: Insertion, Deletion.

Graphs: Basic Concepts, Representations of Graphs: Using Linked List and Adjacency Matrix, Graph Algorithms. Graph Traversals (BFS & DFS), App1ications: Dijkstra‟s Shortest Path, Minimum Spanning Tree Using Prim‟s Algorithm, Warshall‟s Algorithm

Text books:

1. Fundamentals of Data Structures, Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press.
2. G. a. V. Pai, Data Structures and Algorithms-2008, TMH
3. Debasis,Sarnanta- Classic Data Structures- 2/E, PHI,2009

Reference books:

1. E. Horowitz, SartajSahni and Susan anderson, W. H. Freeman -Fundamentals of Data Structures in C
2. Schaum's Series- Introduction of Data Sructure-Prentice Hall of India

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand and Explain Basic Data Structures Such as, Linked Lists, Stacks and Queues, Treeand Graph.
- Select and Apply Appropriate Data Structures to define the particular Problem statement.
- Implement Operations Like Searching/Sorting, Insertion, and Deletion, Traversing on Various Data Structures.
- Determine and Analyze the Complexity of Given Algorithms

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TOE02	3	0	0	3 hours	30	70	3

OPERATING SYSTEMS

Course Objectives:

- To Understand the Services Provided by Operating System
- To Understand the Working and Organization of Process and its Scheduling and Synchronization.
- To Understand the Concept of Deadlock.
- To Understand Different Approaches of Memory Management Techniques.
- To Understand the Structure and Organization of the File System.

Unit I: Definitions, Components and Types of Operating System, Operating System Services, System Calls, System Programs, Process Concepts, Process State & Process Control Block, Process Scheduling, Scheduling Criteria, Scheduling Algorithms, Multiple- Processor Scheduling, Real-Time Scheduling, Threads Introduction

Unit II: The Critical Sections Problem, Semaphores, Classical Problem of Synchronization, Deadlock Characterizations, Method for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock, Combined Approach to Deadlock

Unit III: Storage Management Logical Versus Physical Address Space, Swapping, Contiguous Allocating, Paging, Segmentation, Virtual Memory, Demand Paging, Performance of Demand Paging, Page Replacement, Page Replacement Algorithms, Thrashing, Demand Segmentation

Unit IV: Disk Structure, Disk Scheduling, Disk Management, Swap Space Management, Disk Reliability, Stable Storage Implementation, File Concepts, Directory Structure, Protecting, I/O Subsystem Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem

Unit V: Introduction to distributed systems: I/O Subsystem Principles of I/O Hardware: I/O devices, device controllers, direct memory access. Principles of I/O Software: Goals, interrupt handlers, device drivers, device independent I/O Software. User space I/O software, I/O protection. Distributed file systems: Design, Implementation, and trends. Performance Measurement: Important trends affecting performance issues, performance measures, evaluation techniques, bottlenecks and saturation feedback loops. Case study of UNIX, DOS and WINDOWS operating systems.

Text books:

1. Silberschatz, Galvin, Gagne-Operating System Concepts -Wiley Student Edition
2. Milan Milenkovic-Operating System Concepts & Design-TMH Publication
3. Andrew S. Tanenbaum-Modern Operating System-PHI

Reference books:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, IrwinPublishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hallof India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reillyand Associates

Course Outcomes:

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

- Identify and describe the Services Provided by Operating Systems
- Understand and Solve Problems Involving Process Control, Mutual Exclusion, Synchronization and Deadlock.
- Implement Processor Scheduling, Synchronization and Disk Allocation Algorithms for a Given Scenario
- Apply Various Approaches of Memory Management Techniques
- Analyze Various Operating System Approaches in Linux and Windows

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05PPC06	0	0	2	2 Hours	30	20	1

ELECTROMAGNETIC WAVES LAB

Course Objectives:

- To understand the concepts and working principles of the devices used in propagation of Electromagnetic Waves
- Understand principle of radiation and radiation characteristics of an antenna

List of Experiments:

1. Design of Rectangular waveguide
2. Design of Circular Waveguide
3. Design and Analysis of Transmission line
4. Design of Transmission line as a circuit element
5. Analysis and use of smith chart for impedance calculation
6. Analysis and use of smith chart for admittance calculation
7. Field visualization in waveguide
8. Analysis of radiation pattern and various parameter of antenna
9. Design of Monopole Antenna
10. Design of dipole Antenna

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Use sections of transmission line sections for realizing circuit elements
- Analyze wave propagation on metallic waveguides in modal form
- Understand principle of radiation and radiation characteristics of an antenna

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05PPC07	0	0	2	2 Hours	30	20	1

COMPUTER NETWORK LAB

Course Objectives:

Student will try to learn:

- To understand the working principle of various communication protocols.
- To analyze the various routing algorithms.
- To know the concept of data transfer between nodes.

List of Experiments:

1. Study of Local Area Network.
2. Study of Network Devices in Detail.
3. Program to calculate the channel capacity.
4. Program to calculate SINR (signal-to-noise-plus-interference ratio) using the channel capacity theorem.
5. Program to calculate Bandwidth using the channel capacity theorem.
6. Study of Ethernet.
7. Study of pure aloha protocol.
8. Study of slotted protocol.
9. Study of FTP (File transfer Protocol).
10. Study of Token Bus Protocol.
11. Study of Token Ring Protocol.
12. Study of Network Topologies.
13. Study of Selective Repeat protocol.
14. Study of CSMA-CD Protocol

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- Identify and use various networking components
- Understand different transmission media and design cables for establishing a network.
- Implement device sharing on network
- Learn the major software and hardware technologies used on computer networks.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05PPC08	0	0	2	2 Hours	30	20	1

LIC AND IT'S APPLICATIONS LAB

Course Objectives:

Student will try to learn:

- To design amplifier using transistor.
- To design amplifier using op-amp.
- To design oscillators.
- To design filters.

List of Experiments

1. To design a bistable multivibrator circuit and to draw its output waveform.
2. To design a monostable multivibrator circuit and to draw its output waveform.
3. To design a astable multivibrator circuit and to draw its output waveform.
4. To design an inverting amplifier using opamp (741) and study its frequency response.
5. To design a non-inverting amplifier using opamp (741) and study its frequency response.
6. To design a summing amplifier using opamp (741)
7. To design a differential amplifier using opamp (741) and find its CMRR.
8. To determine SVRR and slew rate of an opamp (741)
9. To design an astable multivirator using 555 timer
10. To design a monostable multivibrator using 555 timer.
11. To design and study a diode clamper circuit.
12. To design and study diode series and shunt clipper.
13. To measure the input impedance of an voltage follower using opamp (741)
14. To design and study comparator circuit using opamp (741)
15. To study the voltage regulation of 78xx and 79xx series of voltage regulators.

Course outcomes:

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

- Design and test amplifiers using transistors and op-amps
- Analyze and test oscillators.
- Implement and design of analog active filters using op-amps.
- Design and test voltage regulated power supply.
- Implement and understand the voltage regulators.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TPC12	3	1	0	4 hours	30	70	4

DIGITAL SIGNAL PROCESSING

Course Objectives:

To provide an overview of topics in basic and advanced digital signal processing techniques with applications to speech and image processing.

Unit I: Introduction of discrete time signals, Representation of signals on orthogonal basis, Sampling and reconstruction of signals, Discrete systems attributes, Introduction of Z-Transform, Analysis of LSI systems, Frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT), Convolution, Correlation, Fast Fourier Transform Algorithm, Decimation –in-Time, Decimation –in-Frequency,

Unit II: Realization of Systems: Realization of digital linear system, Structures for realization of discrete time systems, Structures for IIR and FIR systems, **Realization of IIR filter:** Direct form-I, Direct form-II, Signal flow graph, Cascade form, Parallel structure, Lattice structure, Lattice-Ladder structure. **Realization of FIR filter:** Transversal structure, linear phase realization, Lattice structure.

Unit III: Infinite Impulse Response Filter design (IIR): Features of IIR filters, Design stages, Filter design by Approximation of Derivatives, Impulse invariance method, bilinear transformation method, Butterworth and Chebyshev Design Method, Frequency Transformations in Analog and Digital domain.

Unit-IV: **Finite Impulse Response (FIR) Filter Design:** Linear phase response- Symmetric and Antisymmetric, Design by Window method, Optimal method, Rectangular, Triangular, Hanning, Hamming, Blackman & Kaiser Window, Frequency sampling method, Design of FIR differentiators, Design of Hilbert transformer, Comparison of various design methods.

Unit V: Sampling Theorem and Multi-rate DSP: Introduction, Sampling Rate Conversion by rational factor, Decimation of Sampling rate by an Integer factor, Interpolation of sampling rate by an Integer Factor, Sampling rate alteration or conversion by a rational factor.

Applications of Digital Signal Processing: Introduction, Applications of DSP Digital Sinusoidal Oscillators, Digital Time Control Circuits, Digital Comb Filters. Applications in broader sense: Applications of DSP in Image Processing, Applications of DSP to Radar, Applications of DSP in speech processing.

Text/Reference Books:

1. S. K. Mitra, " Digital Signal Processing: A computer based approach", McGraw Hill, 2011.
2. A.V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing" , Prentice Hall, 1989.
3. J. G. Proakis and D.G. Manolakis, " Digital Signal Processing: Principles, Algorithms And Applications" , Prentice Hall, 1997.

4. L. R. Rabiner and B. Gold, “Theory and Application of Digital Signal Processing” , Prentice Hall, 1992.
5. J. R. Johnson, “ Introduction to Digital Signal Processing” , Prentice Hall, 1992. D. J. DeFatta, J. G. Lucas and W. S. Hodgkiss, “ Digital Signal Processing” , John Wiley & Sons, 1988

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Represent signals mathematically in continuous and discrete-time, and in the frequency domain.
- Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.
- Design digital filters for various applications.
- Apply digital signal processing for the analysis of real-life signals.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TPC13	3	0	0	3 hours	30	70	3

PROBABILITY THEORY AND STOCHASTIC PROCESSES

Course Objectives:

The main objective of this course is to provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science like disease modelling, climate prediction and computer networks etc

Unit I: Introduction to Probability and random variables: Definitions, scope and history; limitation of classical and relative-frequency-base definitions, Sets, fields, sample space and events; axiomatic definition of probability. Combinatorics: Probability on finite sample spaces. Joint and conditional probabilities, independence, total probability; Bayes‟ rule and applications. The random variable concept, Distribution function, Density function, The Gaussian random variable, other distribution and density examples, Conditional distribution and density functions.

Unit II: Operation on One Random Variable – Expectation & Multiple Random Variables Expectation, Moments, Functions that give Moments, Transformations of a random variable, Computer generation of one random variable. Vector random variables, Joint distribution and its properties, Joint density and its properties, Conditional distribution and density, Statistical independence, Distribution and density of a sum of random variables, Central limit theorem.

Unit III: Random Processes-The random process concept, Stationarity and independence, Correlation functions, Measurement of correlation functions, Gaussian random processes, Poisson random process, Complex random processes

Unit IV: Spectral Characteristics of Random Processes-Power density spectrum and its properties, Relationship between power spectrum and autocorrelation function, Cross-Power density spectrum and its properties, Relationship between cross-power spectrum and cross-correlation function, Some noise definitions and other topics, power spectrum of complex processes.

Unit V: Queueing Theory Introduction markov sequences Queueing Systems, Birth-Death Process The M/M/1 Queueing System The M/M/s Queueing System The M/M/1/K Queueing System The M/M/s/K Queueing System.

Text books:

1. Peyton Z. Peebles”Probability, Random Variables & Random Signal Principles “, TMH, 4th Edition, 2001.
2. Donald Childers, Scott Miller “Probability and Random Processes”, ,2Ed,Elsevier,2012

Reference Books:

1. Theory of probability and Stochastic Processes-Pradip Kumar Gosh, UniversityPress
2. Probability and Random Processes with Application to Signal Processing - Henry Stark and John W. Woods, Pearson Education, 3rd Edition.
3. Probability Methods of Signal and System Analysis- George R. Cooper, Clave D. MC Gillem, Oxford, 3rd Edition, 1999.

4. Statistical Theory of Communication -S.P. Eugene Xavier, New Age Publications 2003
5. Probability, Random Variables and Stochastic Processes Athanasios Papoulis andS.Unnikrishna Pillai, PHI, 4th Edition, 2002.

Course Outcomes:

Students will be able to:

- Understand the axiomatic formulation of modern Probability Theory and think of randomvariables as an intrinsic need for the analysis of random phenomena.
- Characterize probability models and function of random variables based on single &multiples random variables.
- Evaluate and apply moments & characteristic functions and understand the concept ofinequalities and probabilistic limits.
- Understand the concept of random processes and determine covariance and spectral densityof stationary random processes.
- Demonstrate the specific applications to Poisson and Gaussian processes and representationof low pass and band pass noise models.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TPE05	3	1	0	4 hours	30	70	4

ANTENNA & WAVE PROPAGATION

Course Objectives:

- To understand the concepts of radiation from loop and wire antenna.
- To understand the basic concept of large gain and broadband antennas.
- To understand the concepts and working principle of currently popular antennas.
- To understand the working of smart antenna and beam forming to fulfill the requirement of latest technologies.

Unit I: Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

Unit II: Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

Unit III: Aperture and Reflector Antennas-Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas. Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.

Unit IV: Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas, Dielectric Resonator Antenna, Antenna Arrays-Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes.

Unit-V: Planar arrays, synthesis of antenna arrays, Basic Concepts of Smart Antennas-Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming, Different modes of Radio Wave propagation used in current practice.

Text/Reference Books:

1. J.D. Kraus, “Antennas”, McGraw Hill, 1988.
2. C.A. Balanis, “Antenna Theory - Analysis and Design”, John Wiley, 1982.
3. R.E. Collin, “Antennas and Radio Wave Propagation”, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, “Antenna Engineering Handbook”, McGraw ill, 1984.
5. I.J. Bahl and P. Bhartia, “Microstrip Antennas”, Artech House, 1980.
6. R.K. Shevgaonkar, “Electromagnetic Waves”, Tata McGraw Hill, 2005
7. R.E. Crompton, “Adaptive Antennas”, John Wiley

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

- Understand the properties and various types of antennas.
- Analyze the properties of different types of antennas and their design.
- Operate antenna design software tools and come up with the design of the antenna of required specifications.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TPE06	3	1	0	4 hours	30	70	4

POWER ELECTRONICS

Course Objectives:

- To provide the students a deep insight in to the working of different switching devices with respect to their characteristics.
- To analyse different converters and control with their applications.
- To Learn to Analyse and design controlled rectifier, DC to DC converters, DC to AC inverters,
- To learn to Design SMPS.

Unit I: Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs.

Unit II: Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and Level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Unit III: Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control Techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

Unit IV: Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters.

Unit V: Switching Power Supplies: Analysis of fly back, forward converters for SMPS, **Applications:** Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

Text /Reference Books:

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4. V.R. Moorthi, “Power Electronics”, Oxford University Press.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
6. G K Dubey, S R Doradla,:Thyristorised Power Controllers”, New Age International Publishers. SCR manual from GE, USA

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- Build and test circuits using power devices such as SCR
- Analyse and design controlled rectifier, DC to DC converters, DC to AC inverters,
- Learn how to analyse these inverters and some basic applications.
- Design SMPS.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TPE07	3	1	0	4 hours	30	70	4

HIGH SPEED DEVICES & CIRCUITS

Course Objectives:

- To understand the Challenges and concepts of High Speed Electronics.
- To understand the Electronic Materials structure and working principles useful for high speed device.
- To understand the concept of MESFET and Hetero Junctions in High Speed Devices and Electronics.

Unit I: Introduction: Requirement of High speed devices, circuits in Electronics; Classification and Properties of Compound Semiconductors, Ternary Compound Semiconductors and their Applications.

Unit II: Crystal Structures of GaAs, Dopants and Impurities in GaAs and InP, Brief overview of GaAs technology for High speed transistors, Epitaxial techniques, Molecular Beam Epitaxy, Liquid Phase Epitaxy.

Unit III: Metal Semiconductor contacts for MESFET-details, Ohmic contacts on Semiconductors.

Unit IV: MESFET operation and I-V Characteristics, Shockley‟s Model, Velocity Saturation Effect, Drain Current Saturation, Self-aligned MESFET-SAINT.

Unit V: Hetero Junctions, High Electron Mobility Transistor(HEMT), Heterojunction Bipolar Transistor (HBT)

Text/Reference Books:

1. S K Ghandhi, VLSI Fabrication Principles, 2nd Edition, Wiley India Pvt Ltd
2. C Y Chang & F Kai, GaAs High Speed Devices: Physics, Technology and Circuit Applications, Wiley, NY, 1994
3. H Beneking, High Speed Semiconductor Devices: Circuit aspects and fundamental behavior, Chapman and Hall, London, 1994
4. S M Sze, High Speed Semiconductor Devices, Wiley, 1990
5. Michael Shur, GaAs Devices and Circuits, Springer

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

- Understand modern day electronic materials structures, properties required and concepts.
- Understand the VLSI Techniques and their Modifications required for High speed electronics.
- Understand the concept of Hetero-junction transistors

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TPE08	3	1	0	4 hours	30	70	4

NANO ELECTRONICS

Course Objectives:

- To learn and understand basic and advance concepts of nanoelectronics.
- To introduce the Nanoelectronics & nano devices,
- To identify quantum mechanics behind nanoelectronics.
- To describe the principle and the operation of nanoelectronic
- To introduce basic theory of Metal Semiconductor Contacts, construction and operation of BJT and MOSFET and basic theory, operation and structure and scaling of MOS transistors.

Unit I: INTRODUCTION TO NANO- ELECTRONICS: The "Top-Down" Approach, Lithography, The "Bottom- Up" Approach, Why Nano electronics? Nanotechnology Potential, MESO structures.

Unit II: QUANTUM MECHANICS OF ELECTRONS: General Postulates of Quantum Mechanics Operators: Eigen values and Eigen functions, Hermitian Operators, Operators for Quantum Mechanics, Measurement Probability, Time Independent Schrodinger equation: Boundary Conditions on the Wave function.

PARTICLE STATISTICS AND DENSITY OF STATES: Density of States, Density of States in Lower Dimensions, Density of States in a Semiconductor, Particle in a box Concepts, Degeneracy.

Unit III: ELECTRONS SUBJECT TO A PERIODIC POTENTIAL-BAND THEORY OF SOLIDS: Crystalline Materials, Electrons in a Periodic Potential, Kronig Penney Model of Band Structure: Effective Mass, Brillouin Zones. Band Theory of Solids, Doping in Semiconductors, Interacting Systems Model, The Effect of an Electric Field on Energy Bands, Band structures of Some Semiconductors, Electronic Band Transitions Interaction of Electromagnetic Energy and Materials, Carbon Nano tubes.

Unit IV: COULOMB BLOCKADE AND THE SINGLE-ELECTRON TRANSISTOR: Coulomb Blockade: Coulomb Blockade in a Nanocapacitor, Tunnel Junctions, Tunnel Junction Excited by a Current Source, Coulomb Blockade in a Quantum Dot Circuit, Resonant Tunneling Diode, The Single-Electron Transistor : Single-Electron Transistor Logic, Other SET and FET Structures : Carbon Nanotube Transistors (FETs and SETs), Semiconductor Nanowire FETs and SETs, Molecular SETs and Molecular Electronics, 2D semiconductors and electronic devices, Graphene, atomistic simulation.

Unit V: Shrink-down approaches of Transistors: Introduction, CMOS Scaling, The nanoscale MOSFET, FinFETs, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.).

Text/ Reference Books:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, the Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand basic concepts of nanoelectronic devices
- Understand various aspects of nano-technology and the processes involved in making nano components and material.
- Leverage advantages of the nano-materials and appropriate use in solving practical problems.
- Understand various aspects of nano-technology and the processes involved in making nano components and material.
- Leverage advantages of the nano-materials and appropriate use in solving practical

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TOE03	3	0	0	3 hours	30	70	3

CRYPTOGRAPHY AND NETWORK SECURITY

Course Objectives:

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks and system.

Unit I: Introduction to Cryptography and Block Ciphers: Introduction to security attacks - services and mechanism - introduction to cryptography - Conventional Encryption: Conventional encryption model - classical encryption techniques - substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and block ciphers - Modern Block Ciphers: Block ciphers principals - Shannon‟s theory of confusion and diffusion - fiestal structure - data encryption standard(DES) - strength of DES - differential and linear crypt analysis of DES - block cipher modes of operations - triple DES – AES.

Unit II: Confidentiality and Modular Arithmetic: Confidentiality using conventional encryption - traffic confidentiality - key distribution - random number generation - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat‟s and Euler‟s theorem - primality testing - Euclid‟s Algorithm - Chinese Remainder theorem - discrete algorithms.

Unit III: Public key cryptography and Authentication requirements: Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffle-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Elgamel encryption - Message Authentication and Hash Function: Authentication requirements - authentication functions - message authentication code - hash functions - birthday attacks – security of hash functions and MACS.

Unit IV: Integrity checks and Authentication algorithms: MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME.

Unit V: IP Security & Key Management and Web & System Security: IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management. Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.

Text Books:

1. William Stallings, “Crpyptography and Network security Principles and Practices”, Pearson/PHI.
2. Wade Trappe, Lawrence C Washington, “ Introduction to Cryptography with coding theory”, Pearson.
3. Douglas Stinson, "Cryptography Theory and Practice", 2 nd Edition, Chapman & Hall/CRC.
4. B. A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill.

Reference Books:

1. W. Mao, “Modern Cryptography – Theory and Practice”, Pearson Education.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Identify computer and network security threats, classify the threats and develop a security model to prevent, detect and recover from the attacks.
- Develop SSL or Firewall based solutions against security threats, employ access control techniques to the existing computer platforms such as Unix and Windows NT.
- Identify factors driving the need for information security

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TOE04	3	0	0	3 hours	30	70	3

ARTIFICIAL INTELLIGENCE

Course Objectives:

- Students will develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
- Students to understand the main approaches to artificial intelligence such as heuristic search, game search, logical inference, decision theory, planning, machine learning, neural networks and natural language processing.

Unit I: Introduction of Artificial Intelligence(AI), Difference between Intelligence and Artificial Intelligence, Definitions of AI, Strong AI and Weak AI, Application areas of AI, Comparison of Conventional and AI Computing, History of AI, Turing Test, Branches of AI, Intelligent Agents, State Space Representation, Production System, Heuristic Search, Search Methods (Uninformed Search and Informed Search), Breadth First Search, Depth First Search, Difference between Breadth First Search and Depth First Search, Hill Climbing, Best First Search.

Unit II: Role of Knowledge Representation in AI, Types of Knowledge, Properties of Knowledge Representation System, Categories of Knowledge Representation Scheme, First Order Predicate Calculus, Well Formed Formula in Predicate Logic, Conversion to Clausal Form, Resolution in Predicate Logic, Semantic Nets, Properties of Semantic Nets, Frames, Scripts, Advantages and Disadvantages of Scripts.

Unit III: Introduction of Expert System, Comparison between Human Expert and Expert System, Comparison between Expert System and Software System, Difference between Knowledgebase and Database, Basic Components of an Expert System, Characteristics of Expert System, Life Cycle Development of Expert System, Advantages of Expert System, Limitation of Expert System, Expert System Tools, Existing Expert Systems (DENDRAL and MYCIN).

Unit IV: Introduction to LISP : Syntax and Numeric Functions, Working with GNU CLISP, Basic Data Objects in GNU CLISP, Basic List Manipulation Functions in GNU CLISP (setq, car, cdr, cons, list, append, last, member, reverse), User Defined Functions in GNU CLISP, Predicates (atom, equal, evenp, numberp, oddp, zerop, >=, <=, listp, null) and Conditionals (cond and if) in GNU CLISP, Logical Functions (not, or, and) in GNU CLISP, Input / Output and Local Variables (read, print, princ, terpri, format, let, prog) in GNU CLISP, Recursion and Iteration(do) in GNU CLISP, Arrays in GNU CLISP.

Unit V: Introduction to PROLOG, Term, Ground Term, Function, Predicate, Features of PROLOG, Program Clause, Unit Clause, Logic Program, Goal Clause, Empty Clause, Simple Query, Conjunctive Query, Structure of PROLOG Program, Working with SWI-Prolog General Syntax of PROLOG, Execution of a Query in Logic Program (Ground Query and Non-Ground Query),

Law of Universal modus ponen, Ground Reduction, PROLOG Control Strategy, Search Tree and Proof Tree, Relational and Arithmetic Operators, Recursion in PROLOG, Lists manipulation in PROLOG, Iterative programming in PROLOG.

Text/Reference Books:

1. E. Rich and K. Knight, "Artificial Intelligence", Forty Sixth Edition, Tata McGrawHill, 2007.
2. D.W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Tenth Edition, Prentice Hall of India, 2001.
3. S. Kaushik, "Logic and Prolog Programming", New Age International Limited, 2006.

Course Outcomes:

Upon completion of this course the students should able to:

- Recognize problems that can be solved using artificial intelligence.
- Implement artificial intelligence algorithms for real-time problems.
- Apply ontological engineering in state space search.
- Analyze various uncertain knowledge and reasoning techniques.
- Implement different types of learning methods.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TBS07	3	0	0	3 hours	30	70	3

LIFE SCIENCE

Course Objectives:

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

Unit I: **Plant Physiology** covering, Transpiration; Mineral nutrition, **Ecology** covering, Ecosystems- Components, types, flow of matter and energy in an ecosystem; Community ecology- Characteristics, frequency, life forms, and biological spectrum; Ecosystem structure- Biotic and a-biotic factors, food chain, food web, ecological pyramids.

Unit II: **Population Dynamics** covering, Population ecology- Population characteristics, ecotypes; Population genetics- Concept of gene pool and genetic diversity in populations, polymorphism and heterogeneity; **Environmental Management** covering, Principles: Perspectives, concerns and management strategies; Policies and legal aspects- Environment Protection Acts and modification, International Treaties; Environmental Impact Assessment- Case studies (International Airport, thermal power plant)

Unit III*:* Molecular Genetics covering, Structures of DNA and RNA; Concept of Gene, Gene regulation, e.g., Operon concept; **Biotechnology** covering, Basic concepts: Totipotency and Cell manipulation; Plant , Methods and uses in agriculture, medicine and health; Recombinant DNA Technology- Basic Techniques and applications.

Unit IV: Biostatistics covering, Introduction to Biostatistics:-Terms used, types of data; Measures of Central Tendencies- Mean, Median, Mode, Normal and Skewed distributions; Analysis of Data- Hypothesis testing and ANNOVA (single factor)

Unit V: Laboratory & Fieldwork Sessions covering, Comparison of stomatal index in different plants; Study of mineral crystals in plants; Determination of diversity indices in plant communities; To construct ecological pyramids of population sizes in an ecosystem; Determination of Importance Value Index of a species in a plant community; Seminar (with PPTs) on EIA of a Mega-Project (e.g., Airport, Thermal/Nuclear Power Plant/ Oil spill scenario); Preparation and extraction of genomic DNA and determination of yield by UV absorbance; Isolation of Plasmid DNA and its separation by Gel Electrophoresis; Data analysis using Bio-statistical tools.

Text/Reference Books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd.
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons.

3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company.
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher.
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers.

Course Outcomes:

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

- explain the differences between biological organisms and manmade systems and classify organisms
- interpret the relationship between the structure and function of proteins, nucleic acid and summarize the industrial applications of biomolecules
- explain the mechanism of respiration
- demonstrate the mapping of genes. and explain the medical importance of gene disorders.
- apply thermodynamic and kinetic principles to biological systems

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06PPC09	0	0	4	4 hours	30	20	2

DIGITAL SIGNAL PROCESSING LAB

Course Objectives:

- To implement Linear and Circular Convolution.
- To implement FIR and IIR filters.

List of Experiments:

Introduction to MATLAB or equivalent software

1. Generation of digital signals and random sequences also determine their correlations.
2. To verify Linear and Circular convolutions.
3. To compute DFT of sequence and its Spectrum Analysis.
4. To implement 8-point FFT algorithm.
5. To design of FIR filters using rectangular window techniques.
6. To design of FIR filters using triangular window techniques.
7. To design of FIR filters using Kaiser Window.
8. To design of Butterworth IIR filter.
9. To design of Chebyshev IIR filter.
10. To generate the down sample (decimation) by an Integer factor,
11. To generate the up sample (interpolation) by an Integer factor

Course Outcomes:

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

- Analyze Finite word length effect on DSP systems.
- Demonstrate the applications of FFT to DSP.
- Implement adaptive filters for various applications of DSP.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06PPC10	0	0	2	2 hours	30	20	1

ELECTRONIC MEASUREMENT LAB

Course Objectives:

- To introduce students to monitor, analyze and control any physical system.
- To understand students how different types of meters work and their construction
- To introduce students a knowledge to use modern tools necessary for electrical projects

List of Experiments:

1. Measurement of unknown self-inductance using maxwell inductance bridge.
2. Measurement of unknown self-inductance of high quality factor using Hay‟s Bridge
3. Measurement of an unknown self -inductance using Anderson Bridge
4. Measurement of an unknown capacitance using De-Sauty‟s Bridge.
5. Measurement of an unknown capacitance using Wein‟s Series Resistance Bridge.
6. Measurement of an unknown capacitance using Schering‟s Bridge
7. To determine the sensitivity of LVDT and hence to show linear range of operation of LVDT.
8. To study the input /output characteristics of LVDT.
9. To study the characteristics of the Thermocouple.
10. To study Galvanometer.

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- To use the techniques and skills for electrical projects.
- Design a system, component or process to meet desired needs in electrical engineering
- Ability to balance Bridges to find unknown values.
- Ability to measure frequency, phase with Oscilloscope.
- Ability to use Digital voltmeters

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06PPC11	0	0	4	4 hours	30	20	2

MINI PROJECT/ELECTRONIC DESIGN WORKSHOP

Course objectives:

- To provide students for knowledge of Electronics Components and soldering techniques and its package information for electronics circuit design.
- Knowledge for the assembling of electronics circuit with components on PCB (Printed Circuit Board) of circuit design.
- Design and development of Small electronic project based on hardware and software for electronics systems

Course Guidelines:

1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and Software. The software part in mini project should be less than 50% of the total work.
3. Mini project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital IC‟s, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of Mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical Issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and layout should be made using cad based pcb simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester**.**
10. Students should follow the standard practice for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

- Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.

- Design, implement and test the prototype/algorithm in order to solve the conceived problem.
- Write comprehensive report on mini project work.

SCHEME OF EXAMINATION
B.TECH. (FOUR YEAR) DEGREE COURSE
FINAL YEAR, ELECTRONICS & COMMUNICATION ENGINEERING
SCHOOL OF STUDIES IN ENGINEERING & TECHNOLOGY, GGVV BILASPUR (CG)
EFFECTIVE FROM SESSION 2021-22
SEMESTER VII (FINAL YEAR)

Sr. No.	Course Code	Course Title	L	T	P	Periods/ week	Evaluation Scheme			Credit
							IA	ESE	Total	
Theory										
1	EC07TPC14	Fiber Optics Communication	3	1	0	4	30	70	100	**3**
2	EC07TPC15	Embedded Systems	3	1	0	4	30	70	100	**3**
3	EC07TPC16	Mobile Communication & Network	3	1	0	4	30	70	100	**3**
4	EC07TPE09 EC07TPE10 EC07TPE11 EC07TPE12	**Program Elective - 3** • Digital Image Processing • Analog & Digital VLSI Design • Estimation and Detection Theory • Advanced Power Electronics	3	1	0	4	30	70	100	**3**
5	EC07TPE13 EC07TPE14 EC07TPE15	**Program Elective - 4** • Microwave Theory & Techniques • Radar & Satellite Comm. • Machine Learning	3	1	0	4	30	70	100	**3**
Practical										
1	EC07PPC12	Fiber Optics Communication Lab	0	0	2	2	30	20	50	**1**
2	EC07PPC13	Design and Simulation Lab	0	0	2	2	30	20	50	**1**
3	EC07PPS01	Seminar on Industrial Training	0	0	0	0	30	20	50	**1**
4	EC07PPS02	Project - I	0	0	10	10	60	40	100	**5**
									Total Credits	**23**

SEMESTER VIII (FINAL YEAR)

Sr. No.	Course Code	Course Title	L	T	P	Periods/ week	Evaluation Scheme			Credit
							IA	ESE	Total	
Theory										
1	EC08TPC17	VLSI Fabrication Technology	3	1	0	4	30	70	100	**3**
2	EC08TPE16 EC08TPE17 EC08TPE18	**Program Elective - 5** • Millimeter Wave Technology • Video Processing • Biomedical Electronics	3	1	0	4	30	70	100	**3**
3	EC08TPE19 EC08TPE20 EC08TPE21	**Program Elective - 6** • Neural Network & Fuzzy logic • Next Gen. Comm. Technology • Wireless Sensor Networks	3	1	0	4	30	70	100	**3**
4	EC08TOE05 EC08TOE06 EC08TOE07	**Open Elective - 3** • Intellectual Property Rights • Principles of Management • Introduction to IOT	3	1	0	4	30	70	100	**3**
Practical										
1	EC08PPS03	Project - II	0	0	18	18	120	80	200	**9**
2	EC08PPS04	Comprehensive viva	0	0	0	0	30	20	50	**1**
									Total Credits	**22**

L: LECTURE T: TUTORIAL P: PRACTICALIA: INTERNAL ASSESSMENT ESE: END SEMESTER EXAM

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPC14	3	1	0	4	30	70	3

FIBER OPTICS COMMUNICATION

Course Objectives:

- To introduce the concept of optical communication system.
- Recognize and classify the structures of Optical fiber and types.
- Discuss the channel impairments like losses and dispersion.
- Measurement devices of optical fiber Communication system.
- To learn the Optical detector and optical transmitter.

Unit I:

Introduction to optical communication, principle of light transmission, propagation of light into fiber, mode theory of a cylindrical waveguide, Ray model.

Unit II:

Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation, Fabrication of fibers and measurement techniques like OTDR.

Unit III:

Optical sources-LEDs and Lasers, Photo-detectors - PIN-diodes, APDs,detector responsivity, noise, optical receivers, Optical link design - BER calculation, power penalties.

Unit IV:

Optical switches - coupled mode analysis of directional couplers, electro-optics switches, Optical amplifiers - EDFA, Raman amplifier, WDM and DWDM systems and Principles of WDM networks.

Unit V:

Nonlinear effects in fiber optic links, Concept of self-phase modulation, group velocity dispersion and Soliton based communication.

Text/Reference Books

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (IndianEdition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.

3. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
4. S.E. Miller and A.G. Chynoweth, eds., Optical fibre telecommunications,Academic Press, 1979.
5. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
6. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, NewYork, 1997
7. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGrawHill, NewYork (1990).

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

- Understand the principles fiber-optic communication, the components and the bandwidthadvantages.
- Understand the properties of the optical fibers and optical components.
- Understand operation of lasers, LEDs, and detectors
- Analyze system performance of optical communication systems.
- Design optical networks and understand non-linear effects in optical fibers

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPC15	3	1	0	4	30	70	3

EMBEDDED SYSTEMS

Course Objective:

Students will be able to:

- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To Introduce Bus Communication in processors, Input/output interfacing.
- To impart knowledge in various processor scheduling algorithms
- To introduce Basics of Real time operating system.

Unit-I: Embedded system Introduction

Overview of microcomputer systems and their building blocks, Review of 8051 Microcontroller, Basic idea of system, Introduction of Embedded system, characteristic of Embedded system.

Unit-II: Components of Embedded system

Functional building blocks of Embedded systems, processor and controller, Interfacing of memory between analog and digital blocks, interfacing with external systems, user interfacing.

Unit-III: Layers of an Embedded system

Introduction, Need for Layering, The Middleware Layer, The Application Layer. Introduction to Real Time Operating Systems, Design tradeoffs due to process compatibility, thermal considerations.

Unit-IV: Networks for Embedded Systems

Serial Communication RS 232 model, I square Model, CAN and CAN Open, SPI and SCI, USB, HDLC, Parallel Communication Basics PCI interface and PCI X- interface, Device Driver Serial Port and Parallel Port.

Unit-V: Methodologies, Life cycle and Modeling

Software Life cycle, Embedded Life cycle Water Fall Model, Spiral Model, RAD Model and Modeling of Embedded system, Simulation and Emulation. Software aspects of embedded

systems: real time programming languages and operating systems for embedded systems.

Text/Reference books:

1. J. W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
3. V. K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
4. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
5. K. J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications".

Course Outcomes:

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

- Acquire a basic knowledge about programming and system control to perform a specific task.
- Acquire knowledge about devices and buses used in embedded networking
- Develop programming skills in embedded systems for various applications.
- Acquire knowledge about basic concepts of circuit emulators**.**
- Acquire knowledge about Life cycle of embedded design and its testing.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPC16	3	1	0	4	30	70	3

MOBILE COMMUNICATION & NETWORKS

Course Objectives:

Students will be able:

- To know the evolution of Mobile communication and cell concept
- To know the fading mechanism and types of fading and effect of fading on Mobile communication.
- To know the role of Equalization and diversity techniques in Mobile communication
- To know the various types of multiple access techniques.
- To know the higher generation cellular standards

Unit-I: Introduction to Mobile Communication

Evolution of mobile communications, Mobile radio around the world, Types of Wireless communication system. Second generation Cellular Networks, GSM, The Cellular Concept-System design Fundamentals: Cellular System, Hexagonal geometry cell and frequency reuse concept, channel assignment strategies, Distance to frequency reuse ratio, channel & Co-channel interference reduction factor, S/I ratio consideration and calculation for minimum Co-channel and adjacent interference, Handoff strategies, Umbrella Cell Concept, Improving Coverage & Capacity in cellular System : splitting, cell sectorization, Repeaters, Micro cell zone concept.

Unit-II : Mobile Radio Propagation

Free space propagation model, The three basic propagation Mechanism: reflection, diffraction, scattering, Practical link budget design, Outdoor Propagation models, Indoor propagation models, Small scale Multipath propagation, Impulse response model of a Multipath Channel, Small scale Multipath measurements, parameters of Mobile multipath channels, types of small scale fading, Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading Rayleigh and Ricean Distributions.

Unit-III: Receiver Structure

Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme. MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing, trade-off. Performance measures-

Probability of Outage, average SNR, average symbol/bit error rate.

Unit-IV: Multiple Access Techniques for Wireless Communication

Introduction, FDMA, TDMA, CDMA: DS-SS,FH-SS, Space division multiple access. Capacity of a cellular systems, Modulation schemes and bit error rate analysis- BPSK, QPSK, QAM and variants.

Unit-V: Higher Generation Cellular Standards

Evolution of Wireless LANs, Wireless LAN Topologies, IEEE 802.11 Standards, Wireless LAN Applications. Trunking and Grade Of Service (GOS).
Enhancements in3G Standards, Architecture and representative protocols in 4G standard, call flow for LTE/ VoLTE, Introduction to 5G.

Text/Reference Books:

1. Wireless Communication, Theodore S. Rappaport, Prentice hall
2. Wireless Communications and Networking, Vijay Garg, Elsevier
3. Wireless digital communication, Kamilo Feher, PHI
4. Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications
5. A. J. Goldsmith, "Wireless Communications," Cambridge Univ. Press, 2005.
6. D. Tse and P. Vishwanath, "Fundamentals of Wireless Communications," Cambridge Univ. Press, 2005.
7. Mobile & Personal Communication System, Pandya R., PHI
8. Modern Mobile Wireless Communication, Haykins S & Moher M, Pearson Ed

Course Outcomes:

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

- Understand the evolution of cellular communication systems upto and beyond 3G
- Design a cellular link and estimate the power budget.
- Choose proper multiple accessing methods depending on channel model
- Identify traffic channels for call processing.
- Calculate key performance metrics of a cellular communication system.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE09	3	1	0	4	30	70	3

DIGITAL IMAGE PROCESSING

Course Objectives:

- To provide the fundamental knowledge on digital image processing.
- To develop the ability to understand and implement various digital image processing algorithms.
- To facilitate the students for analyze and implement various real time digital image processing applications.

Unit I: Image Representation and Image Processing Paradigm

Image, Elements of Image perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels

Image Enhancements: Point operations, Arithmetic operations, Logical operation, Gray level transformations, histogram equalization, histogram specifications, pixel-domain smoothing filters, pixel-domain sharpening filters, two-dimensional DFT and its inverse, Cosine transform, Time-frequency localization, Wavelet transforms

Unit II: Image Filtering and restoration

Noise models, Restoration in the Presence of Noise only using Spatial Filtering and Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering.

Unit III: Color Image Processing

Color models, Color transformations, Color image smoothing and sharpening; Color Segmentation.

Unit IV: Image Compression

Redundancy–inter-pixel and psycho-visual, Lossless compression – predictive, entropy, Lossy compression- predictive and transform coding; Still image compression standards – JPEG and JPEG-2000.

Unit V: Image Segmentation

Detection of discontinuities, Edge linking and boundary detection, thresholding, region-based segmentation, Segmentation using Morphological Watersheds.

Text/Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 3rd Edition, Pearson Education 2010
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2011
3. William K. Pratt, Digital Image Processing, 4th edition, John Wiley, 2007.
4. John C. Russ, The Image Processing Handbook, 6th edition, CRC Press,2011
5. Maria M. P. Petrou and Costas Petrou, Image Processing: The Fundamentals, 2nd Edition, John Wiley & Sons, Ltd, 2010.

Course Outcomes:

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

- Acquire the knowledge of basic image processing concept and image enhancement techniques involved.
- Demonstrate image restoration process and its respective filters required.
- Illustrate the color image processing and various multi-resolution techniques
- Interpret the various image compression techniques and their applications.
- Design the various image segmentation operations for a meaningful partition of objects.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE10	3	1	0	4	30	70	3

ANALOG AND DIGITAL VLSI DESIGN

Course Objective:

- Concepts and understanding of Importance of VLSI design in the field of Electronics and Telecommunication.
- Underlying methodologies for fundamental CMOS Analog and Digit signal Circuits.
- To study analog circuit and its limitations issues in the context of VLSI technology.
- To understand scaling technology
- To design and verify digital circuits by means of computer aided tools.
- To understand issues and tools related to ASIC

Unit I: Introduction to MOS and CMOS

General considerations, C-V characteristics, Short channel effect, Scaling of MOSFET, Constant field scaling and its effects, Constant Voltage Scaling and its effect, second order effect for calculation.

Unit II: MOSFET Models

Low frequency models and its analysis, High frequency models and its analysis, Frequency response, Basic concepts different types of amplifier.

Unit III: CMOS Fabrication Technology

VLSI design flow chart, Y-diagram, CMOS design flow, N-well, P-well, Twin-Tub, CMOS process enhancement, BI-CMOS technology and its application.

Unit IV

Hardware modeling with verilog HDL, Encapsulation, verilog models of propagation delay, net delay, path delay and simulation, Design examples in verilog.

UNIT V: Introduction to ASIC's

Programmable Logic Devices, Programmable Array Logic, concepts of FPGA, CPLD, Different design styles and its comparison.

REFERENCES:

1. Paul R. Gray, Paul. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design

of Analog Integrated Circuits, 5th Edition, Wiley, 2009.

2. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, Tata Mc Graw Hill, 2001
3. Grebene, “Bipolar and MOS Analog Integrated circuit design”, John Wiley & sons, Inc., 2003.
4. Phillip E. Allen, Douglas R. Holberg, “CMOS Analog Circuit Design”, Second edition, Oxford University Press,2002
5. Angsuman Sarkar, Swapnadip De,"VLSI Design and EDA Tools", SCITECH Publication.

Course Outcomes

- Differentiate between Analog and Digital CMOS Integrated Circuits.
- Design analog circuit for different specification
- Analyze various circuit configurations and their application.
- Analyze frequency response of different configuration.
- Identify rapid advances in CMOS technology.
- Identify issues involved in ASIC design.
- Design Synthesizable VHDL code

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE11	3	1	0	4	30	70	3

ESTIMATION AND DETECTION THEORY

Course Objective:

- To teach students the basics of estimation and detection theory.
- To introduce the students to estimation bounds.
- To introduce classical and Bayesian estimators like ML, LS, and MMSE to students.
- To teach hypothesis testing and a number of detectors of signals in noise.
- To introduce the likelihood ratio test and GLRT.
- Exposing the students to applications of estimation and detection is another important goal.

Unit-I

Recap of probability and linear algebra, Introduction of estimation in signal processing, Minimum variance unbiased estimation, Unbiased estimators, Minimum variance criterion, Existence of minimum variance unbiased estimator, Cramer-Rao lower bound (CRLB), scalar parameters, Signal in white Gaussian noise.

Unit-II

Linear models, General minimum variance unbiased estimation, Sufficient statistic, finding minimum variance unbiased estimators, Best linear unbiased estimators (BLUE), Finding the BLUE, Signal processing example.

Unit-III

Maximum Likelihood Estimators(MLE), finding the MLE, Properties of the MLE,MLE for transformed parameters, Extension to a vector parameter, Introduction to Least Square (LS) Approach, Linear least square estimation, Geometrical interpretations of LS estimation, Some examples.

Unit-IV

Bayesian estimators, Priors and Posteriors probabilities, Choosing a Prior PDF, General Bayesian estimators, Minimum mean square estimators (MMSE), Maximum A Posteriori (MAP) Estimators, Linear MMSE Estimation.

Unit-V

Basics of statistical decision theory, Simple hypothesis testing, Likelihood ratio testing, Neyman-Pearson detectors, Detection of known signals in noise, Composite hypothesis testing, Generalized likelihood ratio tests (GLRTs), Deterministic signals with unknown parameters.

Text/Reference books:

1. S. M. Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory, vol. I" Prentice-Hall, 1993.
2. S. M. Kay, "Fundamentals of Statistical Signal Processing: Detection Theory, vol. II" Prentice-Hall, 1998.
3. H. Vincent Poor, "An Introduction to Signal Detection and Estimation" Springer, Second Edition, 1998
4. H. L. Van Trees, "Detection, Estimation, and Modulation Theory, Part I," John Wiley, 1968

Course Outcomes:

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

- Understand the principle of estimation and detection.
- Learn different estimation and detection techniques like ML, LS, MMSE.
- Solve problems that involve estimation of the signal parameters or detection of the presence of signals.
- Compare and evaluate the performance of different estimation technique in different setups.
- Apply these skills to solve problems with practical context.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE12	3	1	0	4	30	70	3

ADVANCED POWER ELECTRONICS

Course Objectives:

- To provide the students with deep insights of different rectifier configurations and their applications.
- To make the student, analyze the DC- DC converters for different mode
- To provide the students with a knowledge of resonant converters and multilevel inverters
- To make the students confident with the use of voltage source inverter and current source inverters.

Unit I: Phase Controlled Rectifiers

Principle of phase control, Single Phase Full wave controlled converters: Midpoint and bridge type, analysis of two pulse bridge converter with continuous current, single phase two pulse converters with discontinuous current

Unit II: DC to DC switch mode Regulators

Introduction, Review of linear power supply and basic dc-dc voltage regulator configurations, Buck converters, Boost converters, Buck-Boost converters and their analysis for continuous and discontinuous conduction mode, other converter configurations.

Unit III: Resonant Converters

Introduction, Need of resonant converters, Classification of resonant converters, Load resonant converters, resonant switch converters, Zero Voltage Switching DC-DC Converters, Zero Current Switching DC-DC Converters, Applications of Resonant Converters.

Unit IV: Multi-level converters

Need for multi-level inverters, Concept of multi-level, Topologies for multi-level: Diode Clamped, Cascaded H-bridge multilevel Converters configurations; Features and relative comparison of these configurations applications.

Unit V: Review of Inverters and Controllers

Review of single phase half bridge, full bridge, bipolar, unipolar, VSI and CSI, review of single phase ac to ac controllers, Phase-Controlled Three-Phase AC Voltage Controllers.

Text Books:

1. Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics – Converters, Applications and Design", John Willey & sons, Inc., 3rd ed., 2003.
2. Muhammad H. Rashid, "Power Electronics - Circuits, Devices and Applications", Prentice Hall of India, 3rd ed., 2009.
3. Modern Power Electronics and AC Drives –B. K. Bose-Pearson Publications, 2002.
4. L. Umanand, "Power Electronics Essentials and Applications", Wiley India Ltd., 2009
5. P.C Sen, 'Thyristor DC Drives', John wiely and sons, New York, 1981.

Course Outcome

At the end of this course, the students will demonstrate the ability to

- Analyze phase controlled rectifier for continuous and discontinuous mode.
- Build and test DC- DC converters circuits and various configurations.
- Study and design resonant converters for different applications.
- Analyze multilevel inverters and understand various topologies.
- Review of single phase voltage source inverters and current source inverters.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE13	3	1	0	4	30	70	3

MICROWAVE THEORY AND TECHNIQUES

Course Objective:

- To understand the concepts of waveguides and various modes.
- To understand the basic concept of various types of Guiding Structure and Passive Components at Microwave.
- To understand the concepts and working principles of Microwave Active Components.
- To understand the concepts and working principles of Microwave System Design and Antenna
- To understand the applications and effect of microwave in various system

Unit I:

Introduction to Microwaves-History of Microwaves, Microwave Frequency bands; Applications of Microwaves, Mathematical Model of Microwave Transmission-Concept of Mode, Features of TEM, TE and TM Modes in Rectangular and Circular waveguide, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission. Introduction of Microwave Systems.

Unit II:

Analysis of RF and Microwave Transmission Lines- Coaxial line, Strip line, Micro strip line. Microwave Network Analysis- Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters. Passive Microwave Devices- Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Resonator.

Unit III:

Microwave active components: Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, Travelling Wave Tube Amplifier, Magnetron.

Unit IV:

Microwave Design Principles-Impedance transformation, Impedance Matching, Introduction of Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Antennas

Antenna parameters, Introduction of Antennas for ground based systems, airborne and satellite systems, Introduction of Planar Antennas for Microwave frequency.

Unit V:

Microwave Measurements- Power, Frequency and impedance measurement at microwave frequency, Noise at microwave frequency and measurement of noise figure. Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Modern Trends in Microwaves Engineering- Effect of Microwaves on human body.

Text/Reference Books:

1. R.E. Collins, Microwave Circuits, McGraw Hill
2. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house
3. S.Y. Liao, Microwave Devices and circuits, Pearson Education
4. David M. Pozar, Microwave Engineering, John Wiley & Sons
5. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

- Understand the need of various microwave system components and their properties.
- Understand the working of various Guiding structures and passive components along with their properties.
- Appreciate that during analysis/ synthesis of microwave active systems, the different mathematical treatment is required compared to general circuit analysis.
- Will able to design the Microwave Devices
- Will able to do the Measurement of Microwave Properties and will learn latest development in Microwave Technology.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE14	3	1	0	4	30	70	3

RADAR AND SATELLITE COMMUNICATION

Course Objectives:

Students will be able:

- To know the evolution of Satellite communication and its concept
- To know the orbital mechanism and different satellite subsystems.
- To know the role of different factors affecting satellite and link budget equation.
- To know the types of multiple access techniques for satellite communication.
- To know the basics, types and working of RADAR.

Unit-I: Introduction to Satellite Communication

Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication

Unit-II

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system- Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

Unit-III: Typical Phenomena in Satellite Communication

Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. Satellite link budget Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

Unit-IV: Modulation and Multiple Access Schemes

Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA

and CDMA.

Unit-V: RADAR

Introduction, Radar block diagram and Operation, Radar Frequencies, Simple form of Radar Equation, Prediction of Range Performance, Minimum Detectable Signals, CW Radar, Tracking Radar, MTI Radar.

Text /Reference Books:

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

Course Outcomes:

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

- Visualize the architecture of satellite systems as a means of high speed, high range communication system.
- State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.
- Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.
- Explain how satellite is controlled to become stationary w.r.t a point on the earth.
- Explain how a single satellite is shared by large number of earth stations on the earth.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07TPE15	3	1	0	4	30	70	3

MACHINE LEARNING

Course Objectives:

- To review and strengthen important mathematical concepts required for ML.
- Introduce the concept of learning patterns from data.
- Introduce the linear regression technique and SVM .
- Introduce the basic neural network and provide background knowledge for deep learning.
- Introduce a few standard clustering techniques.

Unit I:

Review Artificial Intelligence and Mathematical foundations: Matrix Theory and Statistics for Machine Learning.

Introduction: Basic definition, Idea of Machines learning from data, Types of Learning, Classification of problem –Regression and Classification, Supervised and Unsupervised learning.

Unit II:

Linear Regression: Model representation for single variable, Single variable Cost, Function, Gradient Descent for Linear Regression, Gradient Descent in practice.

Unit III:

Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Over fitting. Support Vector Machine, Kernel function and kernel SVM.

Unit IV:

Discussion on clustering algorithms and use-cases cantered around clustering and classification, K-means, Adaptive hierarchical clustering, Gaussian mixture model.

Unit V:

Neural network: Perceptron, multilayer network, back propagation, introduction to deep neural network.

Text Books/References:

1. "Machine Learning: A Probabilistic Perspective" Book by Kevin P. Murphy, The MIT Press,2012.
2. "Pattern Recognition and Machine Learning " Book by Christopher M. Bishop, Springer, 2011
3. Tom Mitchell, Machine Learning, McGraw Hill, 2017.
4. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.
5. Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.

Course Outcomes:

After completion of course, students would be able to:

- Identify ML techniques for basic learning on given Data.
- Apply regression techniques for ML.
- Design and implement machine learning solutions to classification, regression and clustering problems.
- Evaluate and interpret the results of the different ML techniques.
- Explain the basic concept behind deep learning, which is state of the art for ML.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07PPC12	0	0	2	2	30	20	1

FIBER OPTICS COMMUNICATION LAB

Course Objectives:

- Align light waves into small optical components with high precision
- Calculate and simulate the attenuation and signal degradation due to intermodal and intramodal distortion.
- Calculate power coupling losses due to connectors, splices, source output pattern and fiber numerical aperture.
- Understand, compute and simulate the modes in step index fiber and graded index fiber.
- Understand the reliability issues of the highly delicate optical devices.

List of Experiments

1. Study of initial fiber end preparation and connecting plastic fiber to the connector.
2. Study of numerical aperture.
3. Setting up a fiber optic analog link and measurement of propagation loss in the fiber.
4. Study of effect of Lateral, Longitudinal and angular displacement.
5. Study of Time Division multiplexing.
6. Comparison of effect of EMI interference on Copper medium and on optical fiber.
7. Study of characteristics of fiber optic LED and Photo detector.
8. Setting up simple fiber optic Voice link.
9. Setting up fiber optic digital link.
10. Study of Pulse width modulation and demodulation over fiber optic Digital Link.
11. Study of frequency division multiplexing and demultiplexing.
12. Measurement of Bit Error rate.
13. V-I characteristics of LASER source.
14. Analog and digital signal transmission using LASER source.
15. Study of Chromatic dispersion.
16. Measurement of attenuation in attenuator.
17. Measurement of propagation delay time in fiber cable.

Course outcomes

- Apply knowledge of optical communication to various application areas
- Optical fiber is compatible for both analog and digital data transmission.
- VI characterstics of LED and photo diode.
- Performance of optical fiber in presence of dispersion.
- Performance of optical fiber in comparison to the copper wire system in presence of EMI.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC07PPC13	0	0	2	2	30	20	1

DESIGN AND SIMULATION LAB

Course Objectives:

The idea to introduce Design and Simulation lab is:

- To make students familiar with different simulation software like Matlab, Octave, R, and Python.
- To teach basics of simulation and programming used.
- To design a simple system model and simulate their performance.
- The lab will help students in their project work.

Curriculum for the Lab:

- Introduction to different simulation tools like Matlab, Octave, R, and Python.
- Basic Operations on Matrices.
- Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit-impulse, Unit-step, Square, Sawtooth, Triangular, Sinusoidal, Ramp, and Sinc.
- Perform operations like addition, multiplication, scaling, shifting, and folding on signals.
- Dealing with complex signal/sequence.
- To perform convolution between signals and sequences.
- Find the Fourier transform of a given signal and plotting its magnitude and Phase spectrum.
- Computation of unit samples, unit step, and sinusoidal response of the given LTI system and verifying its physical realizability and stability properties.
- Generation of Random number sequence.
- Plot the PDF and CDF for Gaussian, Rayleigh, Rician random variables.
- Plot the frequency histogram for the given data sample.
- Find the mean and variance ofthe given data sample.
- To perform autocorrelation and cross-correlation between signals and sequences.
- Introduction to Simulink.
- A simple control system simulink model.

Further Topics:

- Simulate the BER for 1) AWGN and 2) Rayleigh fading + AWGN channel for ASK, BPSK, QPSK, and QAM modulation.
- GSM IS-95 Simulink model analysis.
- Simple Image processing examples.
- Simple Machine Learning examples.

Suggested Books & Resources: -

- Dukkipati, Rao V. "MATLAB: An Introduction with Applications" New Age International, 2010.
- Shawna Lockhart "An Engineer's Introduction to Programming with MATLAB 2019."
- Ciaburro, Giuseppe "MATLAB for Machine Learning" Packt Publishing, 2017.
- James V. Ston "Bayes' Rule with Python: A Tutorial Introduction to Bayesian Analysis" 2016.
- Tilman M. Davies "The Book of R: A First Course in Programming and Statistics" 1st Edition.
- Hiebeler, David E. “R and matlab David E. Hiebeler” CRC Press 2015.
- Online resource https://in.mathworks.com/help/matlab/
- Online resource https://www.dsprelated.com/
- Online resource https://octave-online.net/
- Online resource https://wiki.octave.org/Category:Resources
- Online resource https://www.r-project.org/
- Online resource https://docs.python.org/3/

Course Outcome:

- The students will learn the different simulation software available.
- The students will learn the mathematical operations on signals and data sets
- The students will simulate and evaluate the performance of a simple communication and control system.
- The students will analyze the sample data set and evaluate its statistical parameters.
- The lab will help students with their project work and future higher studies.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPC17	3	1	0	4	30	70	3

VLSI FABRICATION TECHNOLOGY

Course Objectives:

Students will be able:

- To introduce the brief concept of fabrication technology of both BJT & MOS.
- To learn difficulties in single crystal development.
- To learn different epitaxial growth techniques and their associated problems.
- To introduce the concept of Si atomic structure, atomic planes and structural defects.
- To learn different crystal refinement techniques and wafer design.

Unit I: Introduction to VLSI

Brief overview of processing steps of BJT & MOSFET fabrication, Concept of photolithography, Epitaxy, Self-aligned Technique, Polysilicon & its advantages etc.

Unit II: Silicon Crystal Structure

Basics of Crystal structure and its types and different formations, Hard sphere model of Diamond lattice and its Packing densities, Concept of misfit factor and its importance, Details of Crystal plane-Miller's indices, packing densities, interplane distances and angles between the planes, V-groove etching concept, Direction of line on Si-wafer.

Defects in Crystal structure: Point defects, Line defects, Area dislocation, Volume defects

Unit III: Crystal growth of Si

Carbothermic Reduction process, Bridgemann Technique and its problems, Czochralski technique, its thermodynamics and effect of Pull rate on wafer size.

Dopant incorporation in Si crystal: Segregation coefficient, O_2 incorporation and its removal.

Unit IV: Crystal refinement & wafer preparation

Zone refining technique and its advantages, Wafer preparation, Gettering process and Metallic contaminant removal.

Epitaxy: Types, 3 cardinal rules and their importance, Liquid phase epitaxy, Vapour Phase Epitaxy, Reactor configuration.

Unit V: Chemical Vapour Deposition for Si epitaxy

Silane route, Doping during epitaxy- auto doping, Molecular Beam epitaxy.

Suggested Books & Reference:

1. VLSI Technology, S. M. Sze, McGraw Hill Book Co.
2. VLSI Fabrication Principles, S.K.Gandhi, John Wiley and Sons, NY.
3. VLSI Technology, Chen, Wiley, March.
4. Principles of Microelectronics Technology, D. Nagchoudhary, Wheeler (India).
5. Silicon VLSI Technology: Fundamentals, Practice & Modeling, Plummer, Deal , Griffin, PH, 2001.
6. Microchip Fabrication, P. VanZant, MH, 2000.

Course Outcomes:

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

- Understand the concept of fabrication technology.
- Understand the challenge of single crystal development and wafer design.
- Understand the epitaxial growth techniques and their associated problems.
- Understand the concept of Si atomic structure, atomic planes.
- Understand the structural defects and their effects on wafer quality.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPE16	3	1	0	4	30	70	3

MILLIMETER WAVE TECHNOLOGY

Course objective

Students will be able:

- To understand the Characteristics and requirement of Millimeter Wave Technology
- To understand the concepts and working principles of various guiding Structures at Millimeter Wave Technology.
- To design the Antenna for Millimeter Wave Applications.
- To perform analysis of passive Components at Millimeter Wave
- To understand the basic concept of Active Devices and Link Design at Millimeter Wave.

Unit-I: Introduction to Millimeter wave Technology

Advantages and Challenges of Millimeter Wave Technology, Millimeter Wave Applications, Sources of losses at Millimeter wave; Dielectric Loss, Conduction Loss, Radiation Surface wave losses, Wave propagation, Phase and Group Velocity, Slow and Fast waves.

Unit-II: Guiding Structure

Transmission Lines, TEM, TE and TM modes, Surface Wave in Grounded Dielectric Slab, Parallel Plate Guide, Wave Guides, Rectangular Cavity Resonator, Microstrip Lines, High Frequency Limitation of Microstrip Lines, Microstrip Coupled Lines, Conductor Backed CPW, Substrate Integrated Waveguide (SIW), Design of SIW, Image Guide, Non radiative Dielectric Guide (NRD)

Unit-III: Antennas at Millimeter wave Frequency

Antenna Parameters, Printed Millimeter Wave Antennas, Dipole and Slot Antenna, Loop Antennas, Printed Millimeter Wave Array Antennas, Waveguide Slot Arrays, On Chip Antennas: Design and Challenges.

Unit-IV: Passive Components

Dielectric Resonators, Dielectric Resonators Antenna and its modes, filters, Different types of couplings, Power divider, Directional Coupler, Hybrid Coupler.

Unit-V: Active Components

PIN Diode, Gunn Diode, IMPATT Diode**,** FET, MOSFET, HEMT, Comparison of Solid State Devices**,** Noise and Link Budget, Friss Transmission Equation, Millimeter Wave Systems, Noise Figure for Cascaded System Elements.

Text/Reference Books:

1. S. Rappaport, R.W. Heath, R.C. Daniels and J.N. Murdock, Millimeter Wave Wireless Communication, Prentice Hall.
2. Kao-Cheng Huang, Zhoacheng Wang, "Millimeter Wave Communication Systems", Wiley IEEE press, 2011.
3. NPTEL Lectures of Millimeter Wave Technology Dr. M.K. Mondal.

Course Outcomes:

Upon successful completion of the course, students will demonstrate the ability to

- Need of Millimeter Wave Technology for Communication
- Understand the Selection of suitable Guiding Structure at Millimeter Wave Technology
- Design of Antenna for Millimeter wave Frequency Applications
- Analyze the various Passive Devices at MM Wave Systems
- Understand the principle of Active Devices and Design of MM Wave System

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPE17	3	1	0	4	30	70	3

VIDEO PROCESSING

Course Objectives:

Students will be able:

- To acquire the fundamental knowledge on digital video processing.
- To develop the ability to understand and implement various digital video processing and estimation algorithms.
- To facilitate the students for analyze and implement various real time digital video processing applications.

Unit-I: Basic Steps of Video Processing

Video capture and display, Analog video, Digital Video, Time varying Image Formation models-3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals, filtering operations

Unit-II: Video Modelling

Camera Model-Pinhole Model, CAHV Model, Camera Motions. Object Model- Shape Model, Motion Model. Scene Model, Two-Dimensional Motion Models.

Unit-III: 2-D Motion Estimation

Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, multi resolution motion estimation, Application of Motion Estimation in Video Coding.

Unit-IV: Video Coding

Waveform based coding, Block based transform coding-Unitary Transform, Discrete Cosine Transform, Bit Allocation and Transform Coding Gain, DCT-Based Image Coders and the JPEG Standard, predictive coding, Video Coding Using Temporal Prediction and Transform Coding.

Unit-V: Video Compression

H.261, H.263, MPEG-1, MPEG-2, and MPEG-4.

Text/Reference Books:-

1. The Essential Guide to Video Processing, Al Bovik (Alan C Bovik), Academic Press, Second Edition, 2009

2. Handbook of Image and Video processing, Al Bovik (Alan C Bovik), Academic Press, Second Edition, 2005.
3. Digital Video Processing - A. Murat Tekalp, Prentice Hall, 1995.
4. Yao Wang, Jorn Ostermann, Ya-Qin Zhang, "Video Processing and Communications", First Edition, Prentice Hall, 2002
5. Video Coding for Mobile Communications, David Bull et al, Academic Press.

Course Outcomes:

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

- Understand the basic concept of digital video processing.
- Explain the various video models.
- Apply appropriate motion estimation model for specific application
- Illustrate the video coding techniques for input video
- Interpret the various video compression techniques and their applications.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPE18	3	1	0	4	30	70	3

BIO-MEDICAL ELECTRONICS

Course Objectives:

Students will be able to:

- To introduce the concept of Biomedical Electronics and instrument system.
- To introduce the concept of Physiological system of human Body.
- To learn different Biomedical transducers.
- To learn the Radiology, X-Ray and Angiography.
- To learn the Biotelemetry system and their different Application in patient care.

Unit-I

Concept of Biomedical Electronics, Biomedical Engineering, Biometrics, Components of man instrument system, Data Acquisition techniques.

Unit-II

Brief introduction to human physiology, Physiological system of the Body, cells & their structure, Resting & Action, Bioelectric Potential, The heart & cardiovascular system, Physiological system & Mechanical activity of Heart, Electrocardiographic lead system, Electrocardiogram, Electrocardiography, other Physiological systems.

Unit-III

Biomedical transducers: Displacement, Velocity, Force, Acceleration, Flow, Temperature, Potential, dissolved ions and gases. Bio-electrodes and bio-potential amplifiers for ECG, EMG, EEG, etc.

Unit-IV

Radiology Introduction, Generation of ionizing Radiation, X-Ray System, Radiography, X-Ray Diagnostic, Special techniques in X-Ray, Angiography

Unit-V

Biotelemetry-Introduction, Physiological parameters, Biotelemetry system, Radio telemetry system, Problems in implant telemetry, Application of telemetry in patient care, EEG measurements, EMG measurement, Working Principle of PACE MAKERS.

Text/Reference Books:-

1. Biomedical Instrumentation & Measurement, L. Cromwell, F.J. Weibell and E.A. Pfeiffer, 2nd Ed., PHI
2. Principles of Medical Electronics & Biomedical Instrumentation, C Raja Rao & S.K Guha, University Press
3. Handbook of Biomedical instrumentation, R.S. Khandpur TMH Pub. Co.
4. Principles of Biomedical Instrumentation, Richard Aston
5. Electronics in Medicine and Biomedical Instrumentation, Nandini K. Jog, PHI
6. Biomedical Instrumentation, Dr. A. Arumugam, Anuradha Agencies, Chennai.

Course Outcomes:

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

- Understand the concept of Biomedical Electronics and instrument system.
- Know and Understand the Physiological system of human Body.
- Know and Understand the Radiology, X-Ray and Angiography techniques.
- Know and Understand the Biotelemetry system and their different Application in patient care.
- Know and Understand about Biomedical Transducers.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPE19	3	1	0	4	30	70	3

NEURAL NETWORKS AND FUZZY LOGIC

Course Objectives:

Students will be able:

- To introduce the origin, terminology and basic structure of the Neural Network.
- To introduce the back-propagation as supervised learning.
- To introduce the unsupervised learning based Neural Network.
- To introduce the basic level Fuzzy logic theory and its system.
- To introduce popular applications of Neural Network and Fuzzy based processing.

Unit-I

Biological neurons and McCulloch and Pitts models of neuron, Types of activation functions, Neural networks architectures, Linearly separable and linearly non-separable systems, Features and advantages of neural networks over statistical techniques, Knowledge representation, learning process, error-correction learning, concepts of supervised learning, and unsupervised learning.

Unit-II: Supervised Learning Neural Networks

Single layer perceptron and multilayer perceptron neural networks, their architecture, Error back propagation algorithm, generalized delta rule, learning factors, step learning, Momentum learning, Concept of training, testing and cross-validation data sets for design and validation of the networks.

Unit-III: Unsupervised Learning Neural Networks

Competitive learning networks, kohonen self-organizing networks, K-means and LMS algorithms, Radial Basis Function (RBF) Neural Network, its structure and Hybrid training algorithm for RBF neural networks, Comparison of RBF and MLP networks Learning, Vector Quantization neural network architecture and its training algorithm, Hebbian learning, Hopfield networks, Network, Self-organizing Feature Map, counter-propagation neural network, recurrent neural network, deep learning (Introductory).

Unit-IV: Fuzzy logic & System

Basic Fuzzy logic theory, sets and their properties, Operations on fuzzy sets, Fuzzy relation

and operations on fuzzy relations and extension principle, Fuzzy membership functions and linguistic variables, Fuzzy rules and fuzzy reasoning, Fuzzification and defuzzification and their methods, Fuzzy inference systems, Mamdani Fuzzy models, and Fuzzy knowledge based controllers

Unit-V

Applications of Neural Networks: Pattern classification, Handwritten character recognition, Face recognition, Image compression and decompression.

Applications of Fuzzy Logic and Fuzzy Systems: Fuzzy pattern recognition, Fuzzy image processing, popular applications of fuzzy sets, namely fuzzy reasoning and fuzzy clustering.

Text /Reference Books:

1. Neural Networks: A comprehensive foundation, S. Haykin, 2nd Ed., Pearson Education Asia,1999.
2. Neural Networks and Fuzzy Systems: A dynamical systems approach to machine intelligence, .B. Kosko , Prentice Hall India 1994.
3. Fuzzy Logic with Engineering Applications‖, Thimothy J. Ross, Wiley India Publications
4. Fundamentals of Neural Networks‖,Laurence Fausett, Pearson Education
5. Neural Networks, Fuzzy Logic, and Genetic Algorithms‖,S.Rajasekaran andG. A. Vijaylakshmi Pai, PHI
6. Introduction to Neural Network Using MATLAB", S. N. Sivanandam, S. Sumathi, and S. N. Deepa, Tata McGraw-Hill Publications 2006.
7. Neural Networks – James A Freeman and Davis Skapura, Pearson Education, 2002.
8. Fuzzy Sets and Fuzzy Logic,' G.J. Klir and B. Yuan, Prentice Hall India 1997.

Course Outcomes:

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

- Describe artificial neurons and its role in ANN.
- Explain learning types and elementary structures of ANN.
- Describe perceptron model and single layer neural networks with application.
- Describe back propagation and its role in deep learning.
- Identify and apply basic techniques of fuzzy logic and systems.
- Apply neural network and fuzzy based processing in pattern recognition and Image Processing field.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPE20	3	1	0	4	30	70	3

NEXT GENERATION COMMUNICATION TECHNOLOGY

Course Objective:

- To learn the new communication technologies such as OFDM, MIMO, and massive
- MIMO used in Next Generation communication systems.
- To analysis the performance such as capacity/spectral efficiency and energy
- efficiency of the MIMO and massive MIMO system

Unit-I : Introduction and Preliminaries

Introduction to point-to-point Multi-input Multi-output (MIMO), multiuser MIMO, massive MIMO, Coherence Time, Coherence Bandwidth, Coherence Interval.TDD Coherence Interval structure, Coherence Interval in the context of OFDM modulation, Small-scale and Large-scale fading, Normalized signal model, and SNR.

Unit-II : OFDM

Principle of Orthogonal Frequency Division Multiplexing (OFDM), Multiple access – OFDMA, Implementation of transceivers, Frequency-selective channels, Cyclic Prefix (CP), Performance in the frequency-selective channel, Pilot based channel estimation, Peak-to-average power ratio, Inter-carrier-interference, Parameter adaptation

Unit-III : MIMO Systems

Introduction to MIMO systems, Diversity in wireless channel, Introduction to fading distributions, Analytical MIMO channel models, Independent and identically distributed (uncorrelated) MIMO fading model, Fully correlated MIMO channel model, MIMO channel parallel decomposition.

Unit-IV : MIMO Channel Capacity and Power Allocation

Power allocation in MIMO systems, Uniform power allocation, Adaptive power allocation, MIMO channel capacity, Capacity of i.i.d. Rayleigh fading MIMO channels, Capacity of separately correlated Rayleigh fading MIMO channel

Unit-V : Massive MIMO Systems

Definition of Massive MIMO, Correlated Rayleigh fading, Uplink, and downlink system model, Impact of Spatial channel correlation, Channel hardening and favorable propagation,

Pilot transmission and channel estimation, Spectral Efficiency (SE), Transmit precoding and Receive decoding, Single-cell uplink and downlink SE expressions, Asymptotic analysis,

Text/Reference books:

1. D. Tse and P. Vishwanath, & quot; Fundamentals of Wireless Communications, & quot; Cambridge Univ. Press, 2005.
2. J. Goldsmith, & quot; Wireless Communications, & quot; Cambridge Univ. Press, 2005.
3. R. S. Kshetrimayum, & quot; Fundamentals of MIMO Wireless Communications, " Cambridge University Press,2017.
4. T. L. Marzetta, E. G. Larsson, H. Yang, and H. Q. Ngo, " Fundamentals of Massive MIMO,& quot; Cambridge Univ. Press, 2016.
5. Emil Björnson, Jakob Hoydis, and Luca Sanguinetti, "Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency,& quot; Foundations and Trends® in Signal Processing: Vol. 11: No. 3-4, pp 154-655 (2017).

Course Outcomes:

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

- Learn and understand the different physical layer wireless communication technologies used in 4G and 5G communication systems.
- Apply the concept of Coherence Bandwidth, Coherence Time, Coherence Interval, Small-scale and Large-scale fading to analyze the physical layer performance of 4G and 5G communication systems.
- Evaluate the channel capacity of the MIMO and massive MIMO Systems.
- Analyze the communication system performance under OFDMA.
- Evaluate the spectral efficiency and energy efficiency of massive MIMO technology used in 5G.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TPE21	3	1	0	4	30	70	3

WIRELESS SENSOR NETWORKS

Course Objectives:

- To introduce and understand the concept of Wireless Sensor Network and its applications.
- To identify various network technologies and its challenges.
- To know about various protocols used in Wireless Sensor Networks
- To understand the networking concept in Wireless Sensor Networks
- To introduce operating system in field of Sensor Networks

Unit I:

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

Unit II:

Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

Unit III: MAC protocols and Routing Protocols for Wireless Sensor Networks

Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee, Dissemination protocol for large sensor network. Data dissemination,data gathering, and data fusion, Quality of a sensor network; Real-time traffic support andsecurity protocols.

Unit IV:

Design Principles for WSNs, Gateway Concepts Need for gateway, and WSN to Internet Communication, and Internet to WSN Communication. Single-node architecture, Hardware components & design constraints

Unit V:

Operating systems and execution environments, Introduction to TinyOS and nesC.

Text/Reference Books:

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science
5. Philip Levis, And David Gay "Tiny OS Programming” by Cambridge University Press 2009

Course Outcomes:

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

- Design wireless sensor networks for a given application
- Understand emerging research areas in the field of sensor networks
- Understand MAC and Routing protocols used for different communication standards used in WSN
- Design network like internet to wireless sensor and vice versa using different hardware component
- To create programming environment for designing to run on small, wireless sensors.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TOE05	3	1	0	4	30	70	3

INTELLECTUAL PROPERTY RIGHTS

Course Objective:

Students will be able to:

- Introduce fundamental aspects of Intellectual property Rights.
- Understand rationale behind Patent System.
- Understand WTO, TRIPS and WIPO.
- To get insight about an overview of the IPR regime.

Unit-I: Overview on IPR and its classification

Introduction to IPRs, Basic concepts and need for Intellectual Property – Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR

Unit-II: Patents

Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application , Non Patentable Subject Matter ,Registration Procedure, Rights and Duties of Patentee, Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

Unit-III: Registration of IPRs

Meaning and practical aspects of registration of Copy Rights, Trademarks, Geographical Indications, Trade Secrets, Plant Variety Protection and Industrial Design registration in India and Abroad.

Unit-IV: Agreement and legislation

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, intellectual Property - History of GATT & TRIPS Agreement , Berne convention, Madrid agreement Hague agreement concerning the International Deposit of Industrial Designs ,Lisbon Agreement Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

Unit-V: Digital Products and law

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection, Unfair Competition, Meaning and Relationship between Unfair Competition and IP Laws, Case Studies.

Enforcement of IPRs: Infringement of IPRs, Enforcement Measures, Emerging issues, Case Studies.

Text/Reference books:

1. "Fundamentals of lP for Engineers",K.Bansal & P.Bansal.
2. "Intellectual property right- The Law of Trademarks, Copyrights, Patents and Trade Secrets", Deborah, E. BoDcboux, Cengage learning.
3. "Intellectual Property Rights: Unleashing the Knowledge Economy", Prabuddha Ganguli McGraw Hill Education.
4. Intellectual Propery Rights and Develolment Policy: Report of the Commission on Intellectual Property Rights, London Sepiedber 2002 (Web Resource).
5. "Intellectual Property in New Technological Age", Robert P. Merges, Peter S. Menell, Mark A. Lemley.
6. "Intellectual Property Rights Under WTO" , T. Ramappa, S.Chand, 2008.

E-Resources:

- Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from: http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
- World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from: https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub _489.pdf

Course Outcomes:

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

- Understand Intellectual Property assets.
- Rules and process for IPR registration.
- Assist individuals and organizations in capacity building
- Work for development, promotion, protection, compliance, and enforcement of Intellectual Property and Patenting.
- Legal concepts in Science, Engineering, Technology and Creative Design.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TOE06	3	1	0	4	30	70	3

PRINCIPLES OF MANAGEMENT

Course Objective:

Students will be able to:

- Help the students gain understanding of the functions and responsibilities of managers.
- Provide them tools and techniques to be used in the performance of the managerial job.
- Enable them to analyse and understand the environment of the organization.
- help the students to develop cognizance of the importance of management principles

Unit-I: Introduction

Definition of management, science or art, manager v/s entrepreneur, Types of managers managerial roles and skills, Evolution of management- scientific, human relations, system and contingency approaches, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises, Organization culture and environment, Current trends and issues in management.

Unit-II: Planning

Nature and purpose of planning, types of planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes

Unit-III: Organization

Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management.

Unit-IV: Direction and Leadership

Directing, individual and group behaviour, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication

Unit-V: Controlling

System and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text/Reference books:

1. Robins S.P. and Couiter M., Management, Prentice Hall India, 10th ed., 2009.
2. Stoner JAF, Freeman RE and Gilbert DR, Management, 6th ed., Pearson Education, 2004.
3. Tripathy PC & Reddy PN, Principles of Management, Tata McGraw Hill, 1999.

Course Outcomes:

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

- Discuss and communicate the management evolution and how it will affect future managers.
- Observe and evaluate the influence of historical forces on the current practice of management.
- Identify and evaluate social responsibility and ethical issues involved in business situations and logically articulate own position on such issues.
- Explain how organizations adapt to an uncertain environment and identify techniques managers use to influence and control the internal environment. Practice the process of management's four functions: planning, organizing, leading, and controlling.
- Identify and properly use vocabularies within the field of management to articulate one's own position on a specific management issue and communicate effectively with varied audiences.
- Evaluate leadership styles to anticipate the consequences of each leadership style.
- Gather and analyse both qualitative and quantitative information to isolate issues and formulate best control methods.

Sub Code	L	T	P	Duration	IA	ESE	Credit
EC08TOE07	3	1	0	4	30	70	3

INTRODUCTION TO IOT

Course Objective:

- It will enable student to understand the basics of Internet of things and protocols.
- It introduces some of the application areas where Internet of Things can be applied.
- Students will learn about the middleware for Internet of Things.
- It will enable to understand the concepts of Web of Things.

Unit I : Introduction to Internet of Things

Review of computer communication concepts (OSI layers, components, packet communication, Networks, TCP-IP, subnetting, IPV4 addressing and challenges). IPV6 addressing. IoT architecture reference layer. Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, single board computers, open source hardware, Examples of IoT infrastructure.

Unit II: IoT and M2M

Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER.

Unit III : IOT protocols and Communication Technologies

MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP,XMPP and gateway protocols, IoT Communication Pattern, IoT Protocol Architecture, Selection of Wireless technologies (6LoWPAN, Zigbee, WIFI, BT, BLE,SIG,NFC, LORA, Lifi, Widi).

Unit IV : Data and Analytics for IoT

An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IOT Security, Common Challenges in IOT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

Unit V

IoT Physical Devices and Endpoints: Introduction to Arduino and Raspberry Pi-Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins.

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs WebServer: Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API.

IoT application and its Variants: Case studies: IoT for smart cities, smart grid, health care, agriculture, smart meters.M2M, Web of things, Cellular IoT, Industrial IoT, Industry 4.0,IoT standards.

Text/Reference books:

1. "Internet of Things - A Hands-on Approach", Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. "Internet of Things", Srinivasa K G, CENGAGE Leaning India, 2017.
3. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
4. "Getting Started with Raspberry Pi", Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.
5. "From Machine to Machine to Internet of Things", Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, Elsevier Publications, 2014.

Course Outcomes:

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

- Understand the concepts of Internet of Things.
- Analyze basic protocols in wireless sensor network.
- Design IoT applications in different domain and be able to analyze their performance
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

Code of Conduct for Students

The students are admitted to Guru Ghasidas Vishwavidyalaya to achieve excellence and shape their character to become responsible citizens. They must realize their responsibility towards the Vishwavidyalaya and to its components like faculty, staff and fellow students. Failure to maintain a good standard of conduct shall result in disciplinary action.

Attendance: 75% attendance is compulsory in each subject.

Misconduct: Any of the following activities (but not limited to these only) will be treated as misconduct.

1. Disruption of teaching activities or disturbing the learning process of other students on the campus.
2. Any act on the part of the students, which disrupts functioning of the university, endangers health and safety of campus residents and da mages Vishwavidyalaya properties.
3. Cheating in examination and supplying of false documents / information in order to seek any consideration / favour from the University.
4. Possession or consumption of intoxicating beverages on the campus.
5. Failure to return back loaned material, settle University dues.
6. Possession of weapons.
7. Use of unparliamentarily language while in conversation with Vishwavidyalaya Staff and fellow students.

Disciplinary Actions:

Failure to adhere to good conduct may result in disciplinary actions like:

1. A warning by the authorities.
2. Suspension from a particular class.
3. Suspension / expulsion from the University.
4. Suspension of campus privileges e.g. hostel, accommodation etc.
5. Withholding of examination result or withdrawal of awarded diploma / degree certificate.
6. Any other disciplinary action deemed appropriate by the University authorities.

Discipline Among Students in University Examinations

I UNIVERSITY END SEMESTER EXAMINATIONS

1. The end –semester examination shall be held under the general supervision of the Head of Department by the faculty member concerned. He/she shall be responsible for the fair and orderly conduct of the examination
2. In case of detection of unfair means (as specified in clause 1 of General Guidelines below), the same shall be brought to the notice of the head of the department concerned for further action specified under clause 5 of the General Guidelines below

II ENTRANCE EXAMINATIONS

1. During an entrance examination the candidates shall be under the disciplinary control of the chief Superintendent of the centre who shall issue the necessary instructions. If a candidate disobeys instructions or misbehaves with any member of the supervisory staff or with any of the invigilators at the centre, he/she may be expelled from the examination for that session.

2. The Chief Superintendent shall immediately report the facts of such a case with full details of evidence to the Controller of Examinations who will refer the matter to the Examination Discipline Committee in terms of clause 4 of General Guidelines below. The committee will make recommendations for disciplinary action as it may deem fit to the Vice-Chancellor as provided under clause 7

3. Everybody, before an examination begins, the invigilators shall call upon all the candidates to search their persons, tables, desks, etc. and ask them to hand over all papers, books, notes or other reference material which they are not allowed to have in their possession or accessible to them in the examination hall. Where a late-comer is admitted this warning shall be repeated to him at the time of entrance to the examination hall. They are also to see that each candidate has his/her identification card and hall ticket with him/her.

III GENERAL GUIDELINES

1. Use of Unfair means:
A candidate shall not use means in connection with any examination. The following shall be deemed to unfair means:
a. Found in possession of incriminating material related/unrelated to the subject of the examination concerned.
b. Found copying either from the possessed material or from a neighbour.
c. Inter-changing of answer scripts.
d. Change of seat for copying.
e. Trying to help others candidates.
f. Found consulting neighbours
g. Exchange of answer sheets or relevant materials.
h. Writing some other candidate's register number in the main answer paper.
i. Insertion of pre-written answer sheets (Main sheets or Additional sheets)

j. Threatening the invigilator or insubordinate behaviour as reported by the Chief Superintendent and / or Hall Superintendent.
k. Consulting the invigilator for answering the questions in the examination.
l. Cases of impersonation
m. Mass copying
n. Using electronic devices for the purpose of malpractice.
The Executive Council may declare any other act of omission or commission to be unfair means in respect of any or all the examination.

2. If the Vice-Chancellor is satisfied that there has been mass-scale copying or use or unfair means on a mass-scale at particular centre(s), he may cancel the examination of all the candidates concerned and order re-examination.

3. Where the invigilator in charge is satisfied that one third (1/3) or more students were involved in using unfair-means or copying in a particular Examination Hall. It shall be deemed to be a case of mass copying.
a) The Chief Superintendent of the examination centre shall report to the Controller of Examinations without delay and on the day of the occurrence if possible, each case where use of unfair means in the examination is suspected or discovered with full details of the evidence in support thereof and the statement of the candidate concerned, if any, on the forms supplied by the Controller of Examination for the purpose.
b) A candidate shall not be forced to give a statement but the fact of his /her having refused to make a statement shall be recorded by the Chief Superintendent and shall be got attested by two other members of the supervisory staff on duty at the time of occurrence of the incident.
c) A candidate detected or suspected of using unfair means in the examination may be permitted to answer the question paper, but on separate answer-book. The answer-book in which the use of unfair means is suspected shall be seized by the Chief Superintendent, who shall send both the answer-books to the Controller of Exami9nation with his report. This will not affect the concerned candidate appearing in the rest of the examinations.
d) All cases of use of unfair means shall be reported immediately to the Controller of the Examination by the Centre Superintendent, examiner, paper-setter, evaluator, moderator, tabulator or the person connected with the University examination as the case may be, with all the relevant material.

4. Examination Discipline Committee
a) All the cases of alleged use of unfair means shall be referred to a committee called the Examination Discipline Committee to be appointed by the Vice-Chancellor.
b) The Committee shall consists of five members drawn from amongst the teachers and officers of the university. One member will be nominated as Chairman from amongst them by the Vice Chancellor.
c) A member shall be appointed for a term of two years, and shall be eligible for reappointment.
d) Three members present shall constitute the quorum.
e) Ordinarily, all decisions shall be taken by the Committee by simple majority. If the members cannot reach a consensus, the case shall be referred to the Vice-Chancellor, whose decision shall be final.
f) All decisions taken by the examination discipline committee will be placed before the Vice-Chancellor for approval

g) A candidate within one month of the receipt of the decision of the university may appeal to the Vice-Chancellor, in writing for a review of the case. If the Vice-Chancellor is satisfied that the representation merits consideration, he/she may refer the case back to the Examination Discipline Committee for reconsideration.

5. The Examination Discipline Committee may recommend one of the following punishments for cases of unfair means

Nature of unfair means	**Scale of Punishment**
If the candidate has used unfair means specified in subclause (a) to (g) of clause 3	Cancel all the University examinations registered by the candidate in that session
If the candidate has repeated the unfair means shown at 3(a) to (g) a second time	Cancel the University examination of all subjects registered by the candidate in that session and debar him/her for the next examination session (i.e. all university Examinations in the subsequent session)
If the candidate has repeated the unfair means shown at 3(a) to (g) third time	Cancel the University Examination of all subjects registered by the candidate for that session and debar him/her for two years from registering and appearing for the university Examination
If the candidate has used unfair means specified in subclause (h) of clause	Cancel the University examination of all subjects registered by the candidate during that semester only.
If the candidate has used unfair means specified in subclause (i) of clause	Cancel the University Examination of all subjects registered by the candidate for that session and debar him/her for two subsequent Examination sessions.
If the candidate has used unfair means specified in subclause (j) of clause 3	Cancel the University Examination of all subjects registered by the candidate for that session and debar him/her for two years from registering and appearing for the university Examination
If the candidate has used unfair means specified in	Cancel the University Examination of all subjects

subclause (k) of clause	registered by the candidate for that session
If the candidate has used unfair means specified in subclause (l) of clause	Cancel the University Examination of all subjects registered by the candidate for that session and debar him/her for two years from registering and appearing for the examination sessions. Moreover, relevant legal action shall be initiated if an outsider is involved.
If the candidate used unfair means in subclause (m) of clause 3	a) In the single Hall: cancel the relevant examination taken by the students of that Hall. Debar the concerned Hall superintendent and other involved directly or indirectly from the examination work such as invigilation, question paper-setting, valuation, etc. for the next six examination sessions. b) In a Centre: Cancel the relevant examination taken by the students of the centre. Debar the Hall superintendents and the Chief Superintendent and other involved directly or indirectly from the examination work such as invigilation, question paper setting, evaluation, etc. for the next six examination sessions and cancel the examination centre for two years.

About Ragging

UGC DRAFT REGULATIONS ON CURBING THE MENACE OF RAGGING IN HIGHER EDUCATIONAL INSTITUTIONS, 2009

In exercise of the power conferred by Clause (g) of Sub-Section (1) of Section 26 of the
University Grants Commission Act, 1956, the University Grants Commission hereby
makes the following Regulations, namely-

1. Title, commencement and applicability:-

1.1. These regulations shall be called the "UGC Regulations on Curbing the Menace of Ragging
in Higher Educational Institutions, 2009".
1.2. They shall come into force with immediate effect.
1.3. They shall apply to all the universities established or incorporated by or under a Central
Act, a Provincial Act or a State Act, to all institutions deemed to be university under Section 3 of the UGC Act, 1956, to all other higher educational institutions, including the departments, constituent units and hall the premises (academic, residential, sports, canteen, etc) of such universities, deemed universities and other higher educational institutions, whether located within the campus or outside, and to all means of
transportation of students whether public or private.

2. Objective:-

To root out ragging in all its forms from universities, colleges and other educational institutions in the country by prohibiting it by law, preventing its occurrence by following the provisions of these Regulations and punishing those who indulge in ragging in spite of prohibition and prevention as provided for in these Regulations and the appropriate law in force.

3. Definitions:-

For the purposes of these Regulations:-
3.1 "college" means any institution, whether known as such or by any other name, which provides for a programme of study beyond 12 years of schooling for obtaining any qualification from a university and which, in accordance with the rules and regulations of such university, is recognized as competent to provide for such programmes of study and present students undergoing such programmes of study for the examination for the award of such qualification.
3.2 "Head of the institution" means the 'Vice-Chancellor' in case of a university/deemed to be university, 'Principal' in case of a college, 'Director' in case of an institute.
3.3 "institution" means a higher educational institution (HEI), like a university, a college, an institute, etc. imparting higher education beyond 12 years of schooling leading to a degree (graduate, postgraduate and/or higher level).
3.4 Ragging" means the following: Any disorderly conduct whether by words spoken or written or by an act which has the effect of teasing, treating or handling with rudeness any other student, indulging in rowdy or undisciplined activities which causes or is likely to cause annoyance, hardship or psychological harm or to raise fear or apprehension thereof in a fresher or a junior student or asking the students to do any

act or perform something which such student will not in the ordinary course and which has the effect of
causing or generating a sense of shame or embarrassment so as to adversely affect the physique or psyche of a fresher or a junior student.
3.5 “University” means a university established or incorporated by or under a Central Act, a Provincial Act or a State Act, an institution deemed to be university under Section 3 of the UGC Act, 1956, or an institution specially empowered by an Act of Parliament to confer or grant degrees

4. Punishable ingredients of Ragging:-

- Abetment to ragging;
- Criminal conspiracy to rag;
- Unlawful assembly and rioting while ragging;
- Public nuisance created during ragging;
- Violation of decency and morals through ragging;
- Injury to body, causing hurt or grievous hurt;
- Wrongful restraint;
- Wrongful confinement;
- Use of criminal force;
- Assault as well as sexual offences or even unnatural offences;
- Extortion;
- Criminal trespass;
- Offences against property;
- Criminal intimidation;
- Attempts to commit any or all of the above mentioned offences against the victim(s);
- All other offences following from the defi nition of “Ragging”.

5 Measures for prohibition of ragging at the institution level:-

5.1 The institution shall strictly observe the provisions of the Act of the Central Government and the State Governments, if any, or if enacted, considering ragging as a cognizable offence under the law on a par with rape and other atrocities against women and ill treatment of persons belonging to the SC/ST, and prohibiting ragging in all its forms in all institutions.
5.2 Ragging in all its forms shall be totally banned in the entire institution, including its departments, constituent units, all its premises (academic, residential, sports, canteen, etc) whether located within the campus or outside and in all means of transportation of students whether public or private.
5.3 The institution shall take strict action against those found guilty of ragging and/or of abetting ragging.

6 Measures for prevention of ragging at the institution level:-

6.1 Before admissions:-

6.1.1 The advertisement for admissions shall clearly mention that ragging is totally banned in the institution, and anyone found guilty of ragging and/or abetting ragging is liable to be punished Appropriately (for punishments, ref. section 8 below).

6.1.2 The brochure of admission/instruction booklet for candidates shall print in block letters these Regulations in full (including Annexures).

6.1.3 The 'Prospectus' and other admission related documents shall incorporate all directions of the Supreme Court and / or the Central or State Governments as applicable, so that the candidates and their parents/ guardians are sensitized in respect of the prohibition and consequences of ragging. If the institution is an affi liating university, it shall make it mandatory for the institutions under it to compulsorily incorporate such information in their 'Prospectus'.

6.1.4 The application form for admission/ enrolment shall have a printed undertaking, preferably both in English/Hindi and in one of the regional languages known to the institution and the applicant (English version given in Annexure I, Part I), to be filled up and signed by the candidate to the effect that he/she is aware of the law regarding prohibition of ragging as well as the punishments, and that he/she, if found guilty of the offence of ragging and/or abetting ragging, is liable to be punished appropriately.

6.1.5The application form shall also contain printed undertaking, preferably both in English/Hindi and in one of the regional languages known to the institution and the parent/ guardian (English version given in Annexure I, Part II), to be signed by the parent/ guardian of the applicant to the effect that he/ she is also aware of the law in this regard and agrees to abide by the punishment meted out to his/her ward in case the latter is found guilty of ragging and/or abetting ragging.

6.1.6 The application for admission shall be accompanied by a document in respect of the School Leaving Certificate/ Character Certificate which shall include a report on the behavioral pattern of the applicant, so that the institution can thereafter keep intense watch upon a student who has a negative entry in this regard.

6.1.7 A student seeking admission to the hostel shall have to submit another undertaking in the form of Annexure I (both Parts) along with his/ her application for hostel accommodation.

6.1.8 At the commencement of the academic session the Head of the Institution shall convene and address a meeting of various functionaries/agencies, like Wardens, representatives of students, parents/ guardians, faculty, district administration including police, to discuss the measures to be taken to prevent ragging in the Institution and steps to be taken to identify the offenders and punish them suitably.

6.1.9 To make the community at large and the students in particular aware of the dehumanizing effect of ragging, and the approach of the institution towards those indulging in ragging, big posters (preferably multicolored with different colours for the provisions of law, punishments, etc.) shall be prominently displayed on all Notice Boards of all departments, hostels and other buildings as well as at vulnerable places. Some of such posters shall be of permanent nature in certain vulnerable places.

6.1.10 The institution shall request the media to give adequate publicity to the law prohibiting ragging and the negative aspects of ragging and the institution's resolve to ban ragging and punish those found guilty without fear or favour.

6.1.11 The institution shall identify, properly illuminate and man all vulnerable locations.

6.1.12 The institution shall tighten security in its premises, especially at the vulnerable places. If necessary, intense policing shall be resorted to at such points at odd hours during the early months of the academic session.

6.1.13 The institution shall utilize the vacation period before the start of the new academic year to launch wide publicity campaign against ragging through posters, leaflets, seminars, street plays, etc.

6.1.14 The faculties/ departments/ units of the institution shall have induction arrangements (including those which anticipate, identify and plan to meet any special needs of any specific section of students) in place well in advance of the beginning of the academic year with a clear sense of the main aims and objectives of the induction process.

6.2 On admission:-

6.2.1Every fresher admitted to the institution shall be given a printed leafl et detailing when and to whom he/she has to turn to for help and guidance for various purposes (including Wardens, Head of the institution, members of the anti-ragging committees, relevant district and police authorities), addresses and telephone numbers of such persons/ authorities, etc., so that the fresher need not look up to the seniors for help in such
matters and get indebted to them and start doing things, right or wrong, at their be hest. Such a step will reduce the fresher's dependence on their seniors .
6.2.2 The institution through the leaflet mentioned above shall explain to the new entrants the arrangements for their induction and orientation which promote efficient and effective means of integrating them fully as students.
6.2.3 The leaflet mentioned above shall also tell the fresher's about their rights as bonafide students of the institution and clearly instructing them that they should desist from doing anything against their will even if ordered by the seniors, and that they have nothing to fear as the institution cares for them and shall not tolerate any atrocities against them.
6.2.4 The leaflet mentioned above shall contain a calendar of events and activities laid down by the institution to facilitate and complement familiarization of juniors with the academic environment of the institution.
6.2.5 The institution shall also organize joint sensitization programmes of 'freshers' and seniors.
6.2.6 Fresher shall be encouraged to report incidents of ragging, either as victims, or even as witnesses.

6.3 At the end of the academic year:-

6.3.1 At the end of every academic year the Vice-Chancellor/ Dean of Students Welfare/ Director/ Principal shall send a letter to the parents/ guardians who are completing the first year informing them about the law regarding ragging and the punishments, and appealing to them to impress upon their wards to desist from indulging in ragging when they come back at the beginning of the next academic session.
6.3.2 At the end of every academic year the institution shall form a 'Mentoring Cell' consisting of Mentors for the succeeding academic year. There shall be as many levels or tiers of Mentors as the number of batches in the institution, at the rate of 1 Mentor for 10 freshers and 1 Mentor of a higher level for 10 Mentors of the lower level.

6.4 Setting up of Committees and their functions:-

6.4.1The Anti-Ragging Committee:- The Anti-Ragging Committee shall be headed by the Head of the institution and shall consist of representatives of faculty members, parents, students belonging to the freshers' category as well as seniors and non-teaching staff. It shall consider the recommendations of the Anti-Ragging Squad and take appropriate decisions, including spelling out suitable punishments to those found guilty.

6.4.2 The Anti-Ragging Squad:- The Anti-Ragging Squad shall be nominated by the Head of the institution with such representation as considered necessary and shall consist of members belonging to the various sections of the campus community. The Squad will have vigil, oversight and patrolling functions. It shall be kept mobile, alert and active at all times and shall be empowered to inspect places of potential ragging and make surprise raids on hostels and other hot spots. The Squad shall investigate incidentsof ragging and
make recommendations to the Anti-Ragging Committee and shall work under the overall
guidance of the said Committee.
6.4.3 Monitoring Cell on Ragging:- If the institution is an affiliating university, it shall have a Monitoring Cell on Ragging to coordinate with the institutions affiliated to it by calling for reports from the Heads of such institutions regarding the activities of the Anti-Ragging Committees, Squads, and Mentoring Cells, regarding compliance with the instructions on conducting orientation programmes, counseling sessions, etc., and regarding the incidents of ragging, the problems faced by wardens and other officials, etc. This Cell shall also review the efforts made by such institutions to publicize anti-ragging measures, cross-verify the receipt of undertakings from candidates/students and their parents/guardians every year, and shall be the prime mover for initiating action by the university authorities to suitably amendthe Statutes or Ordinances or Bye-laws to facilitate the implementation of anti ragging measures at the level ofthe institution.

6.5 Other measures:-

6.5.1 The Annexure mentioned in 6.1.4, 6.1.5 and 6.1.7 shall be furnished at the beginning of each academic year by every student, that is, by freshers as well as seniors.
6.5.2 The institution shall arrange for regular and periodic psychological counseling and orientation for students (for freshers separately, as well as jointly with seniors) by professional counselors during the first three months of the new academic year. This shall be done at the institution and department/ course levels. Parents and teachers shall also be involved in such sessions.
6.5.3 Apart from placing posters mentioned in 6.1.9 above at strategic places, the institution shall undertake measures for extensive publicity against ragging by means of audio-visual aids, by holding counseling sessions, workshops, painting and design competitions among students and other methods as it deems fit.
6.5.4 If the institution has B.Ed. and other Teacher training programmes, these courses shall be mandated to provide for anti-ragging and the relevant human rights appreciation inputs, as well as topics on sensitization against corporal punishments and checking of bullying amongst students, so that every teacher is equipped to handle at least the rudiments of the counseling approach.
6.5.5 Wardens shall be appointed as per the eligibility criteria laid down for the post reflecting both the command and control aspects of maintaining discipline, as well as the softer skills of counseling and communicating with the youth outside the class-room situations. Wardens shall be accessible at all hours and shall be provided with mobile phones. The institution shall review and suitably enhance the powers and perquisites of Wardens and authorities involved in curbing the menace of ragging.
6.5.6 The security personnel posted in hostels shall be under the direct control of the Wardens and assessed by them.
6.5.7 Private commercially managed lodges and hostels shall be registered with the local police authorities, and this shall be done necessarily on the recommendation of

the Head of the institution. Local police, local administration and the institutional authorities shall ensure vigil on incidents that may come within the definition of ragging and shall be responsible for action in the event of ragging in such premises, just
as they would be for incidents within the campus. Managements of such private hostels shall be responsible for not reporting cases of ragging in their premises.
6.5.8 The Head of the institution shall take immediate action on receipt of the recommendations of the Anti-Ragging Squad. He/ She shall also take action suo motto if the circumstances so warrant.
6.5.9 Freshers who do not report the incidents of ragging either as victims or as witnesses shall also be punished suitably.
6.5.10 Anonymous random surveys shall be conducted across the 1st year batch of students (freshers) every fortnight during the first three months of the academic year to verify and cross-check whether the campus is indeed free of ragging or not. The institution may design its own methodology of conducting such surveys.
6.5.11 The burden of proof shall lie on the perpetrator of ragging and not on the victim.
6.5.12 The institution shall fi le an FIR with the police / local authorities whenever a case of ragging is reported, but continue with its own enquiry and other measures without waiting for action on the part of the police/ local civil authorities. Remedial action shall be initiated and completed within the one week of the incident itself.
6.5.13 The Migration / Transfer Certificate issued to the student by the institution shall have an entry, apart from those relating to general conduct and behaviour, whether the student has been punished for the offence of committing or abetting ragging, or not, as also whether the student has displayed persistent violent or aggressive behaviour or any desire to harm others.
6.5.14 Preventing or acting against ragging shall be the collective responsibility of all levels and sections of authorities or functionaries in the institution, including faculty, and not merely that of the specific body/ committee constituted for prevention of ragging.
6.5.15 The Heads of institutions other than universities shall submit weekly reports to the Vice-chancellor of the university the institution is affiliated to or recognized by, during the first three months of new academic year and thereafter each month on the status of compliance with anti-ragging measures. The Vice Chancellor of each university shall submit fortnightly reports of the university, including those of the Monitoring Cell on
Ragging in case of an affiliating university, to the Chancellor.
6.5.16 Access to mobile phones and public phones shall be unrestricted in hostels and campuses, except in class-rooms, seminar halls, library etc. where jammers shall be installed to restrict the use of mobile phones.

6.6 Measures for encouraging healthy interaction between freshers and seniors:-

6.6.1 The institution shall set up appropriate committees including the course-in-charge, student advisor, Warden and some senior students to actively monitor, promote and regulate healthy interaction between the freshers and senior students.
6.6.2 Freshers' welcome parties shall be organized in each department by the senior students and the faculty together soon after admissions, preferably within the fi rst two weeks of the beginning of the academic session, for proper introduction to one another and where the talents of the freshers are brought out properly in the presence of the faculty, thus helping them to shed their inferiority complex, if any, and remove their inhibitions.

6.6.3 The institution shall enhance the student-faculty interaction by involving the students in all matters of the institution, except those relating to the actual processes of evaluation and of faculty appointments, so that the students shall feel that they are responsible partners in managing the affairs of the institution and consequently the credit due to the institution for good work/ performance is due to them as well.

6.7 Measures at the UGC/ Statutory/ Regulatory bodies' level:-

6.7.1 The UGC and other Statutory /Regulatory bodies shall make it mandatory for the institutions to compulsorily incorporate in their 'Prospectus' the directions of the Supreme Court and/or the Central or State Governments with regard to prohibition and consequences of ragging, and that noncompliance with the directives against ragging in any manner whatsoever shall be considered as lowering of academic standards by the erring institution making it liable for appropriate action.
6.7.2 The UGC (including NAAC and UGC Expert Committees visiting institutions for various purposes) and similar Committees of other Statutory/Regulatory bodies shall cross verify that the institutions strictly comply with the requirement of getting the undertakings from the students and their parents/ guardians as envisaged under these Regulations.
6.7.3 The UGC and other funding bodies shall make it one of the conditions in the Utilization Certificate for sanctioning any financial assistance or aid to the institution under any of the general or special schemes that the institution has strictly complied with the antiragging measures and has a blemishless record in terms of there being no incidents of ragging during the period pertaining to the Utilization Certificate.
6.7.4 The NAAC and other accrediting bodies shall factor in any incident ofragging in the institution while assessing the institution in different grades.
6.7.5 The UGC shall constitute a Board for Coordination consisting of representatives of the AICTE, the IITs, the NITs, the IIMs, the MCI, the DCI, the NCI, the ICAR and such other bodies which have to deal with higher education to coordinate and monitor the antiragging movement across the country and to make certain policy decisions. The said Board shall meet once in a year in the normal course.
6.7.6 The UGC shall have an Anti-Ragging Cell within the Commission as an institutional mechanism to provide secretarial support for collection of information and monitoring, and to coordinate with the State level and university level Committees for effective implementation of anti-ragging measures.
6.7.7 If an institution fails to curb ragging, the UGC/ the Statutory/ Regulatory body concerned may stop financial assistance to such an institution or take such action within its powers as it may deem fi t and impose such other penalties as provided till such time as the institution achieves the objective of curbing ragging.

7 Incentives for curbing ragging:-

7.1 The UGC shall consider providing special/ additional annual financial grants-in aid to those eligible institutions which report a blemish-less record in terms of there being no incidents of ragging.
7.2 The UGC shall also consider instituting another category of financial awards or incentives for those eligible institutions which take stringent action against those responsible for incidents of ragging.
7.3 The UGC shall lay down the necessary incentive for the post of Warden in order to attract the right type of eligible candidates, and motivate the incumbent.

8 Punishments:-

8.1At the institution level:

Depending upon the nature and gravity of the offence as established by the Anti-Ragging Committee of the institution, the possible punishments for those found guilty of ragging at the institution level shall be any one or any combination of the following:
8.1.1 Cancellation of admission
8.1.2 Suspension from attending classes
8.1.3 Withholding/ withdrawing scholarship/ fellowship and other benefi ts
8.1.4 Debarring from appearing in any test/ examination or other evaluation process
8.1.5 Withholding results
8.1.6 Debarring from representing the institution in any regional, national or international meet, tournament, youth festival, etc.
8.1.7 Suspension/ expulsion from the hostel
8.1.8 Rustication from the institution for period ranging from 1 to 4 semesters
8.1.9 Expulsion from the institution and consequent debarring from admission to any other Institution
8.1.10 Fine of Rupees 25,000/-
8.1.11 Collective punishment: When the persons committing or abetting the crime of ragging
are not identified, the institution shall resort to collective punishment as a deterrent to ensure community pressure on the potential raggers.

8.2 At the university level in respect of institutions under it:

If an institution under a university (being constituent of, affiliated to or recognized by it) fails to comply with any of the provisions of these Regulations and fails to curb ragging effectively, the university may impose any or all of the following penalties on it:
8.2.1 Withdrawal of affi liation/ recognition or other privileges conferred on it
8.2.2 Prohibiting such institution from presenting any students then undergoing any programme of study therein for the award of any degree/diploma of the university
8.2.3 Withholding any grants allocated to it by the university
8.2.4 Any other appropriate penalty within the powers of the university.

8.3 At the UGC level:

If an institution fails to curb ragging, the UGC may impose any or all of the following penalties
on it:
8.3.1 Delisting the institution from section 2(f) and /or section 12B of the UGC Act
8.3.2 Withholding any grants allocated to it
8.3.3 Declaring institutions which are not covered under section 2(f) and or 12B as ineligible for any assistance like that for Major/ Minor Research Project, etc.
8.3.4 Declaring the institution ineligible for consideration under any of the special assistance programmes like CPE (College with potential for Excellence), UPE (University with Potential for Excellence) CPEPA (Centre with Potential for Excellence in a Particular Area), etc.
8.3.5 Declaring that the institution does not have the minimum academic standards and warning the potential candidates for admission accordingly through public notice and posting on the UGC Website.