

STUDENT HAND BOOK 2024-25

(3-1)

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Vision of the Institute

To be recognized as a premier institution in offering the value based and futuristic quality technical education to meet the technological need of the society.

Mission of the the Institute

- To impart value quality technical education through innovative teaching and learning methods.
- To continuously produce employable technical graduates with advanced technical skills to meet the current and future technological need of the society.
- To prepare the graduate for high learning with emphasis on academic and industrial research.

Vision of the Department

To promote excellence in technical education and scientific research in electronics and communication engineering for the benefit of society.

Mission of the Department

- To impart excellent technical education with state of art facilities inculcating values and lifelong learning attitude.
- To develop core competence in our students imbibing professional ethics and team spirit.
- To encourage research benefiting society through higher learning

PEOs:

PEO 1: Establish themselves as successful professionals in their career and higher education in the field of Electronics & Communication Engineering and allied domains through rigorous quality education.

PEO 2: Develop Professionalism, Ethical values, Excellent Leadership qualities, Communication Skills and teamwork in their Professional front and adapt to current trends by engaging in lifelong learning

PEO 3: Apply the acquired knowledge & skills to develop novel technology and products for solving real life problems those are economically feasible and socially relevant

PEO 4: To prepare the graduates for developing administrative acumen, to adapt diversified and multidisciplinary platforms to compete globally.

Quality Policy:

Our quality policy is to continuously strive for over-all development of the department and the students. Our policy is to provide best inputs to the students and to develop them to imbibe the spirit of professionalism, dedication & commitment.

Dress Code

We encourage our students to be formally dressed on and off campus. This nurtures the feeling of equality and belongings among the students fraternity.

All students are required to carry Photo Identity card at all the time while in the campus

POs:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for

i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PSOs:

- Ability to apply concepts of Electronics & Communication Engineering to associated research areas of electronics, communication, signal processing, VLSI, Embedded systems
- Ability to design, analyze and simulate a variety of Electronics & Communication functional elements using hardware and software tools along with analytic skill

A Bird's Eye view about the Institution

CMR Engineering College, popularly known as CMREC is the brain child of the clairvoyant CH.Narasihma Reddy. CMR Engineering College is one of the best engineering Colleges for aspiring engineering students. It is one of the newly established Colleges by CMR Engineering Educational Society. CMR Engineering College was established in 2010 in 10 Acres and built up area of 4,785.78 Sq.m. with a single - minded aim to provide a perfect platform to students in the field of Engineering, Technology for their academic and overall personality development. The college has a very good academic activity which focuses for the campus placement.

The college is approved by the All India Council for Technical Education, New Delhi and is affiliated to JNT University Hyderabad. The CMREC is offering the three under graduate courses in ECE, CSE and MECH, and post graduate course in ECE and CSE.

Today, CMREC has grown in leaps and bounds and it is no wonder that CMREC has become cynosure of the eyes of many, hankering for the distinguished centre of technological learning.

Discipline, Character and Education are the three tenets for which CMREC stands, is certainly the haven where values blend seamlessly to churn out engineers for future.

- Collaborating with Institutions and Industries.
- Promoting research and development programme for the growth of economy.
- Disseminating technical knowledge in the region by continuing education programmes.
- Aiming at continual improvement of all round development of student

Department Profile

The Department of Electronics and Communication engineering of CMR Engineering College was established in the academic year 2010-11 with an annual intake of 120. The intake was increased to 180 from the academic year 2012-13 and later the intake was increased to 240 from the academic year 2013-14. In addition to this intake, the Department has 20% lateral entry students at II B.Tech level.

M.Tech programme was started with 24 intake in the specialization of Embedded Systems from the year 2013-14 and VLSI System Design from the year 2014-15.

The B.Tech (ECE) program is duly approved by the AICTE and Government of Telangana and affiliated to Jawaharlal Nehru Technological University (JNTUH), Hyderabad. Three batches have graduated so far.

Department have 56 faculty and are members of professional bodies like ISTE, IEEE, IETE. Some of the students are the members of IETE student forum and IEEE student branch of the existing

Department. A technical association (ECMRON) of ECE has been formed by the senior students of the department for the benefits of students to impart additional knowledge in the field of E&C Engineering apart from prescribed curriculum.

The Department has well equipped state of art laboratories to gain good knowledge and technical skills in the field of Electronics, Communication, Microwave, VLSI, Digital Signal Processing & Microprocessors & Microcontrollers. The Department periodically organizes seminars, symposia, workshops and guest lectures for the benefit of both the students and the faculty.

Academic Regulations, Course Structure and Detailed Syllabus under Autonomous Status

BACHELOR OF TECHNOLOGY (B.TECH.)

(CMREC - R-22 Regulations)

(Applicable for the batch admitted from 2022-2023)

PRELIMINARY DEFINITIONS AND NOMENCLATURES

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as Autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Hyderabad) and State Government of Telangana.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., (one odd + one even) and supplementary semester.

Branch: Means specialization in a program like B.Tech. Degree program in Electronics and communication Engineering, B.Tech degree program in Computer Science and Engineering, etc.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Backlog Course: A course is considered to be a backlog course, if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry etc., are considered to be foundational in nature.

Commission: Means University Grants Commission (UGC), New Delhi.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Continuous Internal Examination: It is an examination conducted towards sessional assessment.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture/tutorial/lab hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff, and other resources in the process of study for a degree.

Dropping from Semester: Student who does not want to register for any semester can apply in writing in prescribed format before the commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 - point scale.

Honors: An Honors degree typically refers to a higher level of academic achievement at an undergraduate level.

Institute: Means CMR Engineering, Hyderabad unless indicated otherwise by the context.

Massive Open Online Courses (MOOC): MOOC courses inculcate the habit of self-learning. MOOC courses would be additional choices in all the elective group courses.

Minor: Minor are coherent sequences of courses which may be taken in addition to the courses required for the B.Tech. Degree.

Pre-requisite: A specific course or subject, the knowledge of which is required to complete before student register another course at the next grade level.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, UG degree program: Bachelor of Technology (B.Tech.) and PG degree program: Master of Technology (M.Tech.).

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research based work to be taken up by a student during his/her final year to achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a program.

Regulations: The regulations, common to all B.Tech. Programs offered by Institute, are designated as – CMREC Regulations – R-22 and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. Odd semester commences usually in July and even semester in December of every year.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, is an affiliating University.

Withdraw from a Course: Withdrawing from a course means that a student can drop from a course within the first two weeks of odd or even semester. However, he / she can choose a substitute course in place of it by exercising the option within 5 working days from the date of withdrawal.

FOREWORD

The autonomy is conferred to **CMR Engineering College (CMREC)**, Hyderabad by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies including JNT University Hyderabad (JNTUH), Hyderabad and AICTE, New Delhi. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf. Thus, an autonomous institution is given the freedom to have its own **examination system** and **monitoring mechanism**, independent of the affiliating University but under its observance.

CMREC is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies such as Academic Council and Board of Studies (BOS) are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUH to frame the regulations, course structure, and syllabi under autonomous status.

The autonomous regulations, course structure, and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute in order to produce a quality engineering graduate to the society.

All the faculty, parents, and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and from the principal of the institute, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is requested for the successful implementation of the autonomous system in the larger interests of the institute and brighter prospects of engineering graduates.

PRINCIPAL

ACADEMIC REGULATIONS (R22) FOR B.TECH REGULAR
STUDENTS WITH EFFECT FROM THE ACADEMIC YEAR
2022-23

1.0 Under-Graduate Degree Programme in Engineering & Technology (UGP in E&T)

Jawaharlal Nehru Technological University Hyderabad (JNTUH) offers a 4-year (8 semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS) at its non-autonomous constituent and affiliated colleges with effect from the academic year **2022-23**.

Eligibility for Admission

Admission to the undergraduate (UG) programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test conducted by the Telangana State Government (EAMCET) or the University or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the government from time to time.

The medium of instructions for the entire undergraduate programme in Engineering & Technology will be **English** only.

B.Tech. Programme Structure

A student after securing admission shall complete the B.Tech. programme in a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech course. Each student shall secure 160 credits (with CGPA ≥ 5) required for the completion of the undergraduate programme and award of the B.Tech. Degree.

UGC/ AICTE specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms, which are listed below.

Semester Scheme

Each undergraduate programme is of 4 academic years (8 semesters) with the academic year divided into two semesters of 22 weeks (≥ 90 instructional days) each and in each

semester - „Continuous Internal Evaluation (CIE)“ and „Semester End Examination (SEE)“ under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) indicated by UGC, and curriculum/course structure suggested by AICTE are followed.

Credit Courses

All subjects/ courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/ course in an L: T: P: C (lecture periods: tutorial periods: practical periods: credits) structure based on the following general pattern.

- One credit for one hour/ week/ semester for Theory/ Lecture (L) courses or Tutorials.
- One credit for two hours/ week/ semester for Laboratory/ Practical (P) courses.

Courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization Lab are mandatory courses. These courses will not carry any credits.

Subject Course Classification

All subjects/ courses offered for the undergraduate programme in E&T (B.Tech. degree programmes) are broadly classified as follows. The University has followed almost all the guidelines issued by AICTE/UGC.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry subjects
2		ES - Engineering Sciences	Includes Fundamental Engineering Subjects
3		HS – Humanities and Social Sciences	Includes subjects related to Humanities, Social Sciences and Management
4	Core Courses (CoC)	PC – Professional Core	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
5	Elective Courses (ElC)	PE – Professional Electives	Includes elective subjects related to the parent discipline/ department/ branch of Engineering.
6		OE – Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering.
7	Core Courses	Project Work	B.Tech. Project or UG Project or UG Major Project or Project Stage I & II
8		Industry Training/ Internship/ Industry Oriented Mini-	Industry Training/ Internship/ Industry Oriented Mini-Project/ Mini-Project/ Skill Development Courses
9		project/ Mini-Project/ Skill Development Courses	
		Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
10	Minor Courses	-	1 or 2 Credit Courses (subset of HS)
11	Mandatory Courses (MC)	-	Mandatory Courses (non-credit)

Course Registration

A „faculty advisor or counselor“ shall be assigned to a group of 20 students, who will advise the students about the undergraduate programme, its course structure and curriculum, choice/option for subjects/ courses, based on their competence, progress, pre-requisites and interest.

The academic section of the college invites „registration forms“ from students before the beginning of the semester through „on-line registration“, ensuring „date and time stamping“. The online registration requests for any „current semester“ shall be **completed before the commencement of SEEs (Semester End Examinations) of the ‘preceding semester’.**

A student can apply for **on-line** registration, **only after** obtaining the „**written approval**“ from faculty advisor/counselor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with the Head of the Department, Faculty Advisor/ Counselor and the student.

A student may be permitted to register for all the subjects/ courses in a semester as specified in the course structure with maximum additional subject(s)/course(s) limited to 6 Credits (any 2 elective subjects), based on **progress** and SGPA/ CGPA, and completion of the „**pre-requisites**“ as indicated for various subjects/ courses, in the department course structure and syllabus contents.

Choice for „**additional subjects/courses**“, not more than any 2 elective subjects in any Semester, must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/Mentor/HOD.

If the student submits ambiguous choices or multiple options or erroneous entries during **online** registration for the subject(s) / course(s) under a given/ specified course group/ category as listed in the course structure, only the first mentioned subject/ course in that category will be taken into consideration.

Subject/ course options exercised through **on-line** registration are final and **cannot** be changed or inter-changed; further, alternate choices also will not be considered. However, if the subject/ course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any inevitable or unexpected reasons, then the student shall be allowed to have alternate choice either for

a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within a **week** after the commencement of class-work for that semester.

Dropping of subjects/ courses may be permitted, only after obtaining prior approval from the faculty advisor/ counselor „within a period of 15 days“ from the beginning of the current semester.

Open Electives: The students have to choose three Open Electives (OE-I, II & III) from the list of Open Electives given by other departments. However, the student can

opt for an Open Elective subject offered by his own (parent) department, if the student has not registered and not studied that subject under any category (Professional Core,

Professional Electives, Mandatory Courses etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat/should not match with any category (Professional Core, Professional Electives, Mandatory Courses etc.) of subjects even in the forthcoming semesters.

Professional Electives: The students have to choose six Professional Electives (PE-I to VI) from the list of professional electives given.

Subjects/ courses to be offered

A subject/ course may be offered to the students, **only if** a minimum of 15 students opt for it.

More than **one faculty member** may offer the **same subject** (lab/ practical may be included with the corresponding theory subject in the same semester) in any semester. However, selection of choice for students will be based on - „**first come first serve** basis and CGPA criterion“ (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).

If more entries for registration of a subject come into picture, then the Head of the Department concerned shall decide, whether or not to offer such a subject/ course for **two (or multiple) sections**.

In case of options coming from students of other departments/ branches/ disciplines (not considering **open electives**), first **priority** shall be given to the student of the „**parent department**“.

Attendance requirements:

A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects/ courses (including attendance in mandatory courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization Lab) for that semester. **Two periods** of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject. **This attendance should also be Included in the attendance uploaded every fortnight in the University Website.**

Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

A stipulated fee shall be payable for condoning of shortage of attendance.

Shortage of attendance below 65% in aggregate shall in **NO** case be condoned.

Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled, including all academic credentials (internal marks etc.) of that semester. They will not be promoted to the

next semester. They may seek re-registration for all those subjects registered in that semester in which the student is detained, by seeking re-admission into that semester as

and when offered; if there are any professional electives and/ or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

Academic Requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in Item No. 6.

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, if student secures not less than 35% (14 marks out of 40 marks) in the Continuous Internal Evaluation (CIE), not less than 35% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing 'C' grade or above in that subject/ course.

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Real-time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship (or) Seminar, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he (i) does not submit a report on Industry Oriented Mini Project/Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Real-time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship evaluations.

A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such „one reappearance“ evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

Promotion Rules:

S. No.	Promotion	Conditions to be fulfilled
1	First year first semester to first year second semester	Regular course of study of first year first semester.
2	First year second semester to Second year first semester	(i) Regular course of study of first year second semester. (ii) Must have secured at least 20 credits out of 40 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3.	Second year first semester to Second year second semester	Regular course of study of second year first semester.
4	Second year second semester to Third year first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to Third year second semester	Regular course of study of third year first semester.
6	Third year second semester to Fourth year first semester	(i) Regular course of study of third year second semester. (ii) Must have secured at least 72 credits out of 120 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	Fourth year first semester to Fourth year second semester	Regular course of study of fourth year first semester.

A student (i) shall register for all courses/subjects covering 160 credits as specified and listed in the course structure, (ii) fulfills all the attendance and academic requirements for 160 credits, (iii) earn all 160 credits by securing $SGPA \geq 5.0$ (in each semester), and $CGPA \geq 5$ (at the end of 8 semesters), (iv) **passes all the mandatory courses**, to successfully complete the undergraduate programme. The performance of the student in these 160 credits shall be considered for the calculation of the final CGPA (**at the end of undergraduate programme**), and shall be indicated in the grade card / marks memo of IV-year II semester.

If a student registers for „**extra subjects**’ (in the parent department or other departments/branches of Engg.) other than those listed subjects totaling to 160 credits as specified in the course structure of his department, the performances in those „**extra subjects**” (although evaluated and graded using the same procedure as that of the required 160 credits) will not be considered while calculating the SGPA and CGPA. For such „**extra subjects**’ registered, percentage of marks and letter grade alone will be indicated in the grade card / marks memo as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations Items 6 and 7.1 – 7.4 above.

A student eligible to appear in the semester end examination for any subject/ course, but absent from it or failed (thereby failing to secure ‘C’ grade or above) may reappear for that subject/ course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject/ course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.

A student **detained in a semester due to shortage of attendance may be re-admitted in the same semester in the next academic year for fulfillment of academic requirements**. The academic regulations under which a student has been re-admitted shall be applicable. Further, no grade allotments or SGPA/ CGPA calculations will be done for the entire semester in which the student has been detained.

A student **detained due to lack of credits, shall be promoted to the next academic year only after acquiring the required number of academic credits**. The academic regulations under which the student has been readmitted shall be applicable to him.

Evaluation - Distribution and Weightage of Marks

The performance of a student in every subject/course (including practical’s and Project Stage – I & II) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination).

In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 20 marks with a total duration of 2 hours as follows:

1. Mid Term Examination for 30 marks:
 - a. Part - A : Objective/quiz paper/Short Answers for 10 marks.(5*2=10Marks)

b. Part - B : Descriptive paper for 20 marks.

The objective/quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks. The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks. The **average of the two Mid Term Examinations** shall be taken as the final marks for Mid Term Examination (for 30 marks).

The remaining 10 marks of Continuous Internal Evaluation are distributed as:

2. Assignment for 5 marks. (**Average of 2 Assignments** each for 5 marks)
3. Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject for 5 marks.

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

Five (5) marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shall be taken as the final marks for assignment (for 5 marks).

Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the subject concerned for 5 marks before II Mid-Term Examination.

- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores $\geq 35\%$ (14 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.

There is NO Computer Based Test (CBT) for R22 regulations. The

details of the end semester question paper pattern are as follows:

The semester end examinations (SEE), for theory subjects, will be conducted for 60 marks consisting of two parts viz. i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each.

Each of these questions is from each unit and may contain sub-questions. For each

question there will be an “either” “or” choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

- The duration of Semester End Examination is 3 hours.

For practical subjects there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of aim, components/procedure, expected outcome) which shall be evaluated for 10 marks
2. **10 marks for viva-voce** (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 10 marks.
4. The remaining 10 marks are for Laboratory Project, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the cluster / other colleges which will be decided by the examination branch of the University.

In the Semester End Examination held for 3 hours, total 60 marks are divided and allocated as shown below:

1. 10 marks for write-up
 2. 15 for experiment/program
 3. 15 for evaluation of results
 4. 10 marks for presentation on another experiment/program in the same laboratory course and
 5. 10 marks for viva-voce on concerned laboratory course.
- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores $\geq 35\%$ (14 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.

There shall be an Industry training (or) Internship (or) Industry oriented Mini-project (or) Skill Development Courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project in collaboration with an industry of their specialization. Students shall register for this immediately after II-Year II Semester Examinations and pursue it during summer vacation/semester break & during III Year without effecting regular course work. Internship at reputed organization (or) Skill development courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project (or) Internship etc, Internal Supervisor and a Senior Faculty Member of the Department. There shall be **NO internal marks** for Industry Training (or) Internship (or) Mini-Project (or) Skill Development Courses (or) Paper Presentation in reputed journal (or) Industry Oriented Mini Project.

The UG project shall be initiated at the end of the IV Year I Semester and the duration of the project work is one semester. The student must present Project Stage – I during IV Year I Semester before II Mid examinations, in consultation with his Supervisor, the title, objective and plan of action of his Project work to the departmental committee for approval before commencement of IV Year II Semester. Only after obtaining the approval of the departmental committee, the student can start his project work.

UG project work shall be carried out in two stages: Project Stage – I for approval of project before Mid-II examinations in IV Year I Semester and Project Stage – II during IV Year II Semester. Student has to submit project work report at the end of IV Year II Semester. The project shall be evaluated for 100 marks before commencement of SEE Theory examinations.

For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall approve the project work to begin before II Mid-Term examination of IV Year I Semester. The student is deemed to be not eligible to register for the Project work, if he does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule.

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such „one reappearance“ evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

For Project Stage – II, the external examiner shall evaluate the project work for 60 marks and the internal project committee shall evaluate it for 40 marks. Out of 40 internal marks, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 20 marks and Project Supervisor shall evaluate for 20 marks. The topics for Industry Oriented Mini Project/ Internship/SDC etc. and the main Project shall be different from the topic already taken. The student is deemed to have failed, if he (i) does not submit a

report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

For conducting viva-voce of project, University selects an external examiner from the list of experts in the relevant branch submitted by the Principal of the College.

A student who has failed, may reappear once for the above evaluation, when it is scheduled again; if student fails in such „one reappearance“ evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

A student shall be given only one time chance to re-register for a maximum of two subjects in a semester:

- If the internal marks secured by a student in the Continuous Internal Evaluation marks for 40 (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Viva-voce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects.

A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the class work in next academic year.

In the event of the student taking this chance, his Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled.

Grading Procedure

Grades will be awarded to indicate the performance of students in each Theory Subject, Laboratory/Practicals/ Industry-Oriented Mini Project/Internship/SDC and Project Stage. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.

As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a Subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
Greater than or equal to 90%	O (Outstanding)	10
80 and less than 90%	A ⁺ (Excellent)	9
70 and less than 80%	A (Very Good)	8
60 and less than 70%	B ⁺ (Good)	7
50 and less than 60%	B (Average)	6
40 and less than 50%	C (Pass)	5
Below 40%	F (FAIL)	0

Absent	Ab	0
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A student who has obtained an „F’ grade in any subject shall be deemed to have „**failed**’ and is required to reappear as a „supplementary student” in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.

To a student who has not appeared for an examination in any subject, „**Ab**’ grade will be allocated in that subject, and he is deemed to have „**Failed**’. A student will be required to reappear as a „supplementary student” in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remain the same as those obtained earlier.

A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

A student earns Grade Point (GP) in each subject/ course, on the basis of the letter grade secured in that subject/ course. The corresponding „Credit Points” (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

Credit Points (CP) = Grade Point (GP) x Credits For a course

A student passes the subject/ course only when **GP ≥ 5** (‘C’ grade or above)

The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (ΣCP) secured from all subjects/ courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

$$\text{SGPA} = \{ \sum_{i=1}^N C_i G_i \} / \{ \sum_{i=1}^N C_i \} \dots \text{For each semester,}$$

where „i” is the subject indicator index (considering all subjects in a semester), „N” is the no. of subjects „**registered**’ for the semester (as specifically required and listed under the course structure of the parent department), C_i is the no. of credits allotted to the i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses (of 160) in **all** semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula

$$\text{CGPA} = \{ \sum_{j=1}^M C_j G_j \} / \{ \sum_{j=1}^M C_j \} \dots \text{for all S semesters registered}$$

j=1

(i.e., up to and inclusive of S semesters, $S \geq 2$),

where „M’ is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has „**registered**’ i.e., from the 1st semester onwards up to and inclusive of the 8th semester, „j’’ is the subject indicator index (takes into account all subjects from 1 to 8 semesters), C_j is the no. of credits allotted to the jth subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that jth subject. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA:

Course/ Subject	Credi ts	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	$4 \times 8 = 32$
Course 2	4	O	10	$4 \times 10 = 40$
Course 3	4	C	5	$4 \times 5 = 20$
Course 4	3	B	6	$3 \times 6 = 18$
Course 5	3	A+	9	$3 \times 9 = 27$
Course 6	3	C	5	$3 \times 5 = 15$
	21			152

$$\text{SGPA} = 152/21 = 7.24$$

Illustration of Calculation of CGPA up to 3rd Semester:

Semes ter	Course / Subject Title	Credi ts Allott ed	Lett er Grad e Secured	Correspon ding Grade Point (GP)	Cred it Poin ts (CP)
I	Course 1	3	A	8	24
I	Course 2	3	O	10	30
I	Course 3	3	B	6	18
I	Course 4	4	A	8	32
I	Course 5	3	A+	9	27
I	Course 6	4	C	5	20
II	Course 7	4	B	6	24
II	Course 8	4	A	8	32
II	Course 9	3	C	5	15
II	Course 10	3	O	10	30
II	Course 11	3	B+	7	21
II	Course 12	4	B	6	24
II	Course 13	4	A	8	32
II	Course 14	3	O	10	30
III	Course 15	2	A	8	16

III	Course 16	1	C	5	5
III	Course 17	4	O	10	40
III	Course 18	3	B+	7	21
III	Course 19	4	B	6	24
III	Course 20	4	A	8	32
III	Course 21	3	B+	7	21
	Total Credits	69		Total Credit Points	518

$$\text{CGPA} = 518/69 = 7.51$$

The calculation process of CGPA illustrated above will be followed for each subsequent semester until 8th semester. The CGPA obtained at the end of 8th semester will become the final CGPA secured for entire B.Tech. Programme.

For merit ranking or comparison purposes or any other listing, **only** the „rounded off” values of the CGPAs will be used.

SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in first attempt. Otherwise the SGPA and CGPA shall be mentioned only on the Memorandum of Grades in which sitting he passed his last exam in that semester. However, mandatory courses will not be taken into consideration.

Passing Standards

A student shall be declared successful or „passed” in a semester, if he secures a GP ≥ 5 (‘C’ grade or above) in every subject/course in that semester (i.e. when the student gets an SGPA ≥ 5.0 at the end of that particular semester); and he shall be declared successful or

„passed” in the entire undergraduate programme, only when gets a CGPA

≥ 5.00 (‘C’ grade or above) for the award of the degree as required.

After the completion of each semester, a grade card or grade sheet shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, grade earned, etc.) and credits earned. **There is NO exemption of credits in any case.**

Declaration of results

Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9.

For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

$$\% \text{ of Marks} = (\text{final CGPA} - 0.5) \times 10$$

Award of Degree

A student who registers for all the specified subjects/ courses as listed in the course structure and secures the required number of 160 credits (with CGPA ≥ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have „**qualified**’ for the award of B.Tech. degree in the branch of Engineering selected at the time of admission.

A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.

A student with final CGPA (at the end of the undergraduate programme) > 8.00 , and fulfilling the following conditions - shall be placed in „**First Class with Distinction**’.

However, he

- (i) Should have passed all the subjects/courses in „**First Appearance**’ within the first 4 academic years (or 8 sequential semesters) from the date of

commencement of first year first semester.

- (ii) Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.

A student not fulfilling any of the above conditions with final CGPA > 8 shall be placed in '**First Class**'.

Students with final CGPA (at the end of the undergraduate programme) ≥ 7.0 but < 8.00 shall be placed in '**First Class**'.

Students with final CGPA (at the end of the undergraduate programme) ≥ 6.00 but < 7.00 , shall be placed in „**Second Class**'.

All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the undergraduate programme) ≥ 5.00 but < 6 , shall be placed in „**pass class**".

A student with final CGPA (at the end of the undergraduate programme) < 5.00 will not be eligible for the award of the degree.

Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of „**Gold Medal**".

Award of 2-Year B.Tech. Diploma Certificate

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) upto B.Tech. II Year II Semester, if the student want to exit the 4-Year B.Tech. Program and *requests for the 2 -Year B. Tech. (UG) Diploma Certificate*.
2. The student **once opted and awarded 2-Year UG Diploma Certificate, the student will be permitted to join** in B. Tech. III Year I Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree ONLY in the next academic year along with next batch students. *However, if any student wishes to continue the study after opting for exit, he/she should register for the subjects/courses in III Year I Semester before commencement of class work for that semester.*
3. *The students, who exit the 4-Year B. Tech. program after II Year of study and wish to re-join the B.Tech. program, must submit the 2 -Year B. Tech. (UG) Diploma Certificate awarded to him, subject to the eligibility for completion of Course/Degree.*
4. A student may be permitted to take one year break after completion of II Year II Semester or B. Tech. III Year II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next**

Academic Year in the same college and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program).

Withholding of results

If the student has not paid the fees to the University at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

Transitory Regulations

A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of R20 Regulations due to lack of attendance, shall be permitted to join I year I Semester of R22 Regulations and he is required to complete the study of B.Tech. Programme within the stipulated period of eight academic years from the date of first admission in I Year.
2. A student who has been detained in any semester of II, III and IV years of R20 regulations for want of attendance, shall be permitted to join the corresponding semester of R22 Regulations and is required to complete the study of B.Tech. within the stipulated period of eight academic years from the date of first admission in I Year. The R22 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

3. A student of R20 Regulations, who has been detained due to lack of credits, shall be promoted to the next semester of R22 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including both R20 & R22 regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The R22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in R22 Regulations:

4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R22 Regulations. **There is NO exemption of credits in any case.**
6. If a student is readmitted to R22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R22 Regulations will be substituted by another subject to be suggested by the University.

Note: If a student readmitted to R22 Regulations and has not studied any subjects/topics in his/her earlier regulations of study which is prerequisite for further subjects in R22 Regulations, the College Principals concerned shall conduct remedial classes to cover

those subjects/topics for the benefit of the students.

Student Transfers

There shall be no branch transfers after the completion of admission process.

There shall be no transfers from one college/stream to another within the constituent colleges and units of Jawaharlal Nehru Technological University Hyderabad.

The students seeking transfer to colleges affiliated to JNTUH from various other Universities/institutions have to pass the failed subjects which are equivalent to the subjects of JNTUH, and also pass the subjects of JNTUH which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of JNTUH, the students have to study those subjects in JNTUH in spite of the fact that those subjects are repeated.

The transferred students from other Universities/Institutions to JNTUH affiliated colleges who are on rolls are to be provided one chance to write the CBT (for internal marks) in the **equivalent subject(s)** as per the clearance letter issued by the University.

The autonomous affiliated colleges have to provide one chance to write the internal examinations in the **equivalent subject(s)** to the students transferred from other universities/institutions to JNTUH autonomous affiliated colleges who are on rolls, as per the clearance (equivalence) letter issued by the University.

Scope

The academic regulations should be read as a whole, for the purpose of any interpretation.

In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

The University may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the University authorities.

Where the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

**ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME) FROM
THE AY 2023-24**

1. Eligibility for the award of B.Tech Degree (LES)

The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.

2. The student shall register for 120 credits and secure 120 credits with CGPA ≥ 5 from II year to IV-year B.Tech. Programme (LES) for the award of B.Tech. Degree.
3. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.
4. The attendance requirements of B. Tech. (Regular) shall be applicable to B.Tech. (LES).

5. Promotion rule

S. No	Promotion	Conditions to be fulfilled
1	Second year first semester to second year second semester	Regular course of study of second year first semester.
2	Second year second semester to third year first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 24 credits out of 40 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to third year second semester	Regular course of study of third year first semester.
4	Third year second semester to fourth year first semester	(i) Regular course of study of third year second semester. (ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester.

6. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).
7. LES students are not eligible for 2-Year B. Tech. Diploma Certificate.

Malpractices Rules

Disciplinary Action For / Improper Conduct in Examinations

	Nature of Malpractices/Improper conduct	Punishment
	If the student:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the student is to be cancelled and sent to the University.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for

		examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive
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		semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the chief superintendent/assistant – superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
8.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
9.	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared for including practical examinations and project work and shall not be permitted for

		the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared for including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award a suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.
2. Punishment for Institutions: (if the squad reports that the college is also involved in encouraging malpractices)
 - a. A show-cause notice shall be issued to the college.
 - b. Impose a suitable fine on the college.
 - c. Shifting the examination center from one college to another college for a specific period of not less than one year.

ACADEMIC CALENDER (2024-25)

II & III B.Tech. I – SEMISTER				
S. No.	EVENT	DATE		DURATION
		FROM	TO	
		29.07.2024		---
1	Commencement of Class Work			8 weeks
2	First Spell of Instructions	29.07.2024	21.09.2024	1 Week
3	First Mid Term Examinations (Theory & Practical)	23.09.2024	28.09.2024	9 weeks
4	Second Spell of Instructions (Including Dussehra Vacation)*	30.09.2024	30.11.2024	---
5	Submission of First Mid Term Marks to Exam Branch	05.10.2024		---
6	Parents Teacher's Meeting	14.10.2024		---
7	Second Mid Term Examinations (Theory & Practical)	02.12.2024	07.12.2024	1 Week
8	Submission of Second Mid Term Marks to Exam Branch	14.12.2024		---
9	Preparation Holidays and Practical Examinations	09.12.2024	14.12.2024	1 week
10	End Semester & Supplementary Examinations	16.12.2024	28.12.2024	2 Weeks
II & III B.Tech. II – Semester				
S. No.	EVENT	DATE		DURATION
		FROM	TO	
		30.12.2024		---
1	Commencement of II-SEM Class work			8 weeks
2	First Spell of Instructions	30.12.2024	22.02.2025	1 week
3	First Mid Term Examinations	24.02.2025	01.03.2025	8 weeks
4	Second Spell of Instructions	03.03.2025	26.04.2025	---
5	Submission of First Mid Term Marks to Exam Branch	08.03.2025		---
6	Parents Teacher's Meeting	15.03.2025		---
7	Second Mid Term Examinations	28.04.2025	03.05.2025	1 week
8	Summer Vacation	05.05.2025	31.05.2025	4 weeks
9	Submission of Second Mid Term Marks to Exam Branch	14.06.2025		---
10	Preparation and Practical Examinations	02.06.2025	07.06.2025	1 week
11	End Semester & Supplementary Examinations	09.06.2025	21.06.2025	2 weeks
12	Commencement of Class Work for the next A.Y-2025-2026	30.06.2025		

Department Event Planner A.Y 2024-2025

S.NO	DATE	NAME OF THE EVENT
1	29/07/2024	Commencement of Class Work
2	29/07/2024-21/09/2024	I Spell of instructions
3	02/08/2024-03/08/2024	IV B.Tech Mini Project Work Review I
4	07/08/2024	Student Workshop-I for IV Year
5	06/09/2024	Student Workshop-I for III Year
6	07/08/2024	Industrial visit
6	07/09/2024 - 08/09/2024	IV B.Tech Mini Project Work Review II
7	09/09/2024 - 12/09/2024	I MID Exams for IV Year
8	30/09/2024-03/10/2024	I MID Lab Internal Exam for IV Years
9	13/09/2024 - 14/09/2024	IV B.Tech Major Project Work Review I
10	14/09/2024	Guest lecture for III year
11	27/09/2024 - 28/09/2024	IV B.Tech Mini Project Work Review II
12	30/09/2024-05/10/2024	I MID Exams for II & III Years
13	30/09/2024-03/10/2024	I MID Lab Internal Exam for II, & III Years
14	05/10/2024	Submission of I mid marks to University
15	16/09/2024	Professional Body Activities
16	07/10/2024-12/10/2024	Dussehra Recess
17	30/09/2024-30/11/2024	II Spell of instructions (Including I mid examinations)
18	30/09/2024-05/10/2024	I MID Exams for II, III & IV Years
19	30/09/2024-03/10/2024	I MID Lab Internal Exam for II, & III Years
20	05/10/2024	Submission of I mid marks to University
21	21/10/2024 - 22/10/2024	IV B.Tech Mini Project Work Review III
22	11/11/2024 - 16/11/2024	II MID Exams for IV Years
23	12/11/2024	Workshop for II year
24	15/11/2024 - 16/11/2024	IV B.Tech Major Project Work Review II
25	28/11/2024 - 30/11/2024	II MID Lab Internal Exam for II, & III Years
26	02/12/2024 - 07/12/2024	II MID Exams for II&III Years
27	09/12/2024 - 11/12/2024	Lab External Exam for IV Year
28	09/12/2024 - 11/12/2024	Lab External Exam for II, & III Years
29	09/12/2024 - 14/12/2024	Preparation Holidays and Practical Examinations
30	14/12/2024	Submission of II mid marks to University
31	16/12/2024 -28/12/2024	End Semester Exams

LIST OF SUBJECTS:

1	Microprocessor and Microcontrollers
2	Electronic measurements and instrumentation
3	Business economics & Financial Analysis
4	Control systems
5	Professional Elective-I
6	Microcontrollers Lab
7	Advanced English Communication Skills lab
8	Advanced Communication lab
9	Constitution of India

MICROPROCESSORS & MICROCONTROLLERS

Subject Code: EC501PC

Class: III Year B.Tech ECE I-Semester

BY

D. LATHA

ASSISTANT PROFESSOR

<u>S.NO</u>	<u>CONTENT</u>
-------------	----------------

- | | |
|--------|---|
| (1) - | Preamble/Introduction |
| (2) - | Prerequisites |
| (3) - | Objectives and Outcomes |
| (4) - | Syllabus
1.R22-CMREC
2.GATE
3.IES |
| (5) - | List of Expert Details(Local/National/International
with Contact details/Profile link/Blogs/their research
Contribution towards the subject) |
| (6) - | Journals with min 5 ref paper for literature study |
| (7) - | Subject -Lesson plan |
| (8) - | Suggested Books (prescribed and References) |
| (9) - | Websites for self learning Resources like
<i>www.geeksforgeeks.org, www.schools.com, Coursera,edX,
Udemy, Khan Academy, NPTEL</i> etc along Registration procedures) |
| (10) - | Question Banks
1.JNTUH/Model papers
2.GATE |
| (11) - | Two case study presentations with Project /
Product/ Model /prototypes/ Industrial applications. |
| (12) - | Assignment Question/Innovative Assignments sets. |
| (13) - | List of topics for studentsSeminars with Guidelines |
| (14) - | STEP/Course material in softcopy |
| (15) - | Expert Lectures with topics & Schedules |

1. Preamble/Introduction:

This course introduces the basic concepts of Assembly language programming of microprocessors & Microcontrollers. The emphasis of this course is laid on the basic interfacing techniques of microprocessor, microcontroller with other devices.

To make the students understand Microprocessors and Microcontrollers in order to equip them with the necessary tools for the analysis of Electronic equipment in the field of Microprocessors & Embedded systems to be used in industries, research field and in commercial field applications.

The applications of this subject include Real time applications like Washing machines, Smart phones, computers, Laptops etc. and also used in some toys, traffic lights, design of robots etc

2. Prerequisites:

This subject recommends basic knowledge & practice on

- Digital Logic Design concepts
- Computer Organization & Architecture concepts
- Basics of Digital IC's

3. Objectives:

1. To familiarize the architecture of microprocessors and microcontrollers
2. To provide the knowledge about interfacing techniques of bus & memory.
3. To understand the concepts of ARM architecture
4. To study the basic concepts of Advanced ARM processors

Outcomes:

Upon completion of the subject, students will be able to:

- **Identify** and **analyze** the internal organization, design of 8086 microprocessor and its pins description.
- **Develop** and **interpret** simple Arithmetic and Logical programs using different instructions and addressing modes of 8051 microcontroller.
- **Apply** and **Design** the concepts of interfacing microcontroller with I/O devices, different advanced devices and serial data communication standards.
- **Examine** the internal architecture and organization of ARM processors along with pins description, **Classify** different instructions and addressing modes.
- **Understand** the internal architecture and organization of Cortex and OMAP processors.

4. Syllabus:

UNIT-I

8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.

Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT – II

Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters

UNIT –III

I/O And Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232, USB.

UNIT –IV

ARM Architecture: ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

UNIT – V

Advanced ARM Processors: Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

1. GATE

- 8086 Architecture, Instruction Set and Assembly Language Programming of 8086
- Introduction to Microcontrollers, 8051 Real Time Control

3.IES

- Microprocessors:
Architecture and instruction set of Microprocessor 8086, Assembly language Programming.

5. List of Expert Details:

- Douglas V. Hall- State University of New York at Albany
Phone: [\(503\) 725-5396](tel:5037255396), Email: halld@pdx.edu
- A K Ray Ph.D.(IIT Kharagpur) Professor
E-mail- ajoy_ray2004@yahoo.com
- LAXMIDHAR BEHERA, Indian Institute of Technology – Kanpur
Phone: +91-512-2597198, Email: lbehera@iitk.ac.in
- Prof. Roopa R Kulkarni, GIT, Belgaum
Email: roopa.patavardhan@gmail.com/roopakulkarni-ece@dsatm.edu.in
Contact Number: +919880156678
- Dr.N. D. Tiwari, Professor, NRCM, Hyderabad
Contact number: 9165437352

6. Journals with min 5 reference papers for literature study:

- Smart Home Automated Control System Using Android Application and Microcontroller
<https://www.ijser.org/researchpaper/Smart-Home-Automated-Control-System-Using-Android-Application-and-Microcontroller.pdf>
- A PLL clock generator with 5 to 110 MHz of lock range for microprocessors

<https://ieeexplore.ieee.org/document/165341>

- Energy dissipation in general purpose microprocessors
<https://ieeexplore.ieee.org/document/535411>
- A 160-mhz, 32-b, 0.5-w CMOS RISC microprocessor
<https://ieeexplore.ieee.org/document/542315>
- Design and Implementation of Microcontroller Based Automatic Solar Radiation Tracker
<http://inpressco.com/wp-content/uploads/2014/04/Paper49230-234.pdf>

7. Subject Lesson Plan:

Topic Name	No. of classes	Text books
UNIT I:8086 Architecture		
8086 Architecture	02	T1, R2
Functional diagram	02	T1, R2
Register Organization	01	T1, R2
Memory Segmentation, Memory addresses	01	T1, R2
Physical Memory Organization	01	T1, R2
interrupts of 8086, Instruction formats	01	T1, R2
Addressing modes	02	T1, R2
Instruction Set	02	T1, R2
Assembler Directives, Macros	01	T1, R2
Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations	02	
Total No. of Classes	15	
UNIT II:Introduction to Microcontrollers		
Overview of 8051 Microcontroller	01	T1, R1,R3
Architecture, I/O Ports	01	T1, R1,R3
Memory Organization	01	T1,R1,R3

Addressing Modes and Instruction set of 8051	02	T1,R1,R3
Programming Timer Interrupts	02	T1,R1,R3
Programming External Hardware Interrupts	01	T1,R1,R3
Programming the Serial Communication Interrupts	02	T1,R1,R3
Programming 8051 Timers and Counters	02	T1,R1,R3
Total No. of Classes	12	
UNIT III:I/O And Memory Interface		
LCD Interface to 8051	01	T1,R2,R3
Keyboard Interface to 8051	01	T1,R2,R3
External Memory RAM, ROM Interface	02	T1,R2,R3
ADC, DAC Interface to 8051	02	T1,R2,R3
Serial Communication Standards, Serial Data Transfer Scheme	02	T1,R2,R3
On board Communication Interfaces-I2C Bus, SPI Bus, UART	03	T1,R2,R3
External Communication Interfaces-RS232,USB	02	T1,R2,R3
Total No. of Classes	13	
UNIT IV:ARM Architecture		
ARM Processor fundamentals	01	T2
ARM Architecture	02	T2
Register, CPSR	02	T2
exceptions and interrupts interrupt vector table	02	T2
ARM instruction set – Data processing, Branch instructions, load store instructions	02	T2
Software interrupt instructions, Program status register instructions	02	T2
loading constants, Conditional execution	01	T2
Introduction to Thumb instructions	02	T2
Total No. of Classes	14	
UNIT V:Advanced ARM Processors		

Introduction to CORTEX Processor and its architecture	03	T2,R4
OMAP Processor and its Architecture	02	T2,R4
Total No. of Classes	05	
Total No. of Classes	59	

8. Suggested Books:

TEXT BOOKS:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K. M. Bhurchandani, TMH, 2nd Edition 2006.
2. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012

REFERENCE BOOKS:

1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed, 2004.
2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006.
3. The 8051 Microcontrollers, Architecture and Programming and Applications -K. Uma Rao, Andhe Pallavi, Pearson, 2009.
4. Digital Signal Processing and Applications with the OMAP- L138 Experimenter, Donald Reay, WILEY 2012.

9. Websites for self learning Resources:

1. NPTEL VIDEO LECTURES:
<https://nptel.ac.in/courses/108/105/108105102/>
<https://nptel.ac.in/courses/117/104/117104072/>
2. <https://www.youtube.com/watch?v=iV4TPnOLvgA>
3. <https://www.youtube.com/watch?v=Po6Wybl1tIk>
4. <https://www.youtube.com/watch?v=0-ljoBEi-WE>
5. <https://www.youtube.com/watch?v=liRPtvj7bFU>-Introduction to Microprocessors & Microcontrollers .

10. Question Banks

1.JNTUH/Model papers

CodeNo:136CT

JAWAHARLALNEHRUTECHNOLOGICALUNIVERSITYHYDERABAD

R16

**B. Tech III Year II Semester
Examinations, May -**

2019MICROPROCESSORSANDMICRO CONTROLLERS

(ElectronicsandCommunicationEngineering)

Time:3hours

Max.Marks:75

Note:ThisquestionpapercontainstwopartsAandB.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit.Each question carries10 marks and mayhavea, b, cas sub questions.

PART-A

(25Marks)

Whatis theimportanceof pipeliningconcept in 8086microprocessor?

[2]

- b) Howto calculatethe Physical memoryof 8086, with oneexample? [3]
- c) Explaintheimportanceof8051Microcontrollerover microprocessor. [2]
- d) ListoutDifferentinterrupts of8051Microcontroller. [3]
- e) Explain the importanceof Memoryinterfacingof8051. [2]
- f) Writeshort noteson USB. [3]
- g) Listoutdifferent 16-bitregistersusedinARMprocessor. [2]
- h) Listoutfew comparisonsofARMandMicrocontroller. [3]
- i) ExpandOMPAprocessorandits memorycapacity. [2]
- j) Explainthedifferentapplicationsof OMPAprocessor. [3]

PART- B

(50Marks)

2.a)

Drawtheinternalarchitectureof8086microprocessorandexplainthefunctionofeachblock indetail.

b)

Listoutdifferentstringmanipulationinstructionsused in8086 microprocessorandexplain each onein detail. [5+5]

OR

3.a) DefineAddressingmode?

ListoutdifferentAddressingmodesusedin8086microprocessor.

- b) DefineMacro?Explainitsimportancein8086programming. [6+4]

- 4.a) List out the important features of 8051 Microcontroller along with its applications.
b) Draw the Pin Diagram of 8051 Microcontroller and explain each pin in detail. [5+5]

OR

5. Explain the following SFRs of 8051 Microcontroller in detail:
a) SCON b) TCON c) PCON [3+3+4]

6.a)

Draw the internal circuit diagram of UART and explain the function of each block in detail.

- a) Explain the different Serial data transfer schemes used in serial communication. [5+5]

OR

7.a) Draw the PIN diagram of RS-232 serial communication scheme and explain importance of each pin.

- b) Draw the interface circuit diagram of LCD with 8051 and explain its operation in detail. [5+5]

8.a)

Draw the internal architecture of ARM processor and explain function of each block in detail.

- b) Define Pipeline? Explain the Five stage pipeline concept in ARM processor. [5+5]

OR

9.a)

List out different Branch instructions used in ARM processor and explain each one in detail.

- b) Explain the concept of Software interrupt instruction in detail. [5+5]

10.

List out different classifications of OMPA processor and explain each one type in detail. [10]

OR

11.a)

Explain the concept of superscalar pipeline of CORTEX processor along with circuit diagram.

- b) Explain the different applications of CORTEX processor in detail. [5+5]

III B.Tech. II Semester Regular/Supplementary Examinations, May/June -2014

MICRO PROCESSORS AND MICRO CONTROLLERS

(Comm to Electronics and Communication Engineering and Electronics and Computer

Engineering and Biomedical Engineering and Electronics and Instrumentation Engineering)

Answer any FIVE Questions

All Questions carry equal marks

1. a) Explain the function of QS0 and Qs1 signals of 8086.
b) Present the architectural differences between 8086 and 8088.
c) Draw and discuss read cycle timing diagram of 8086 in minimum mode. (3+6+6)
2. a) Write an ALP to authenticate the given password .
b) Draw and discuss interrupt structure of 8086 in detail.
c) Describe the procedure to code intersegment jump and intrasegment jump. (6+6+4)
3. a) Write the salient features of strobed I/O mode of operation of 8255. Also present the input and output control signal definitions.
b) Design an interface between 8086 CPU and two chips of 16K X 8 EPROM and two chips of 32K X 8 RAM. Select the starting address of EPROM suitably. The RAM address must start at 00000H. (7+8)
4. a) Draw and explain the internal architecture of 8257.
b) Explain the initialization sequence of 8259A using a flow chart.
c) Explain the FIFO status word of 8279. (6+5+4)
5. a) Draw and discuss the register set of 80386 and explain the function of each of the registers in brief. (9+6)
b) Explain the different additional addressing modes supported by 80386 over 80286.
6. a) Draw the 8051 connection diagram and explain. (5+10)

b) Explain different addressing modes of 8051 using relevant example instructions.

7. a) Explain the function of each bit of STATUS register in PIC 16F8XX.

b) Write the features of I/O ports of PIC 16F877. (6+9)

8. Discuss in detail ARM architecture and organization. (15)

R16

Code No: 135BF

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, October - 2020

MICROPROCESSORS AND MICROCONTROLLERS

(Common to EEE, EIE)

Time: 2 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

- 1.a) Draw the flag register of 8086 microprocessor and explain each flag.
- b) What are interrupts? What are their uses? List and explain different interrupt supported by 8086 microprocessor. [7+8]
- 2.a) Discuss different string instruction of 8086 microprocessor with examples.
- b) List and explain different addressing modes supported by the 8086 microprocessor. [7+8]
- 3.a) With a neat diagram, explain the internal architecture of 8051 microcontroller.
- b) List the applications of 8051 microcontrollers. [8+7]
- 4.a) Discuss the internal memory organization of 8051 microcontroller.
- b) Explain the use of timers and counters available in 8051 microcontroller. [7+8]
- 5.a) Compare between serial communication and parallel communication.
- b) What are D-to-A controllers? Explain their applications. [8+7]
- 6.a) What is RS232? Explain its interfacing with 8051.
- b) Explain the working of I2C Bus. [8+7]
- 7.a) Draw and explain the program status register of ARM processors.
- b) Discuss the main characteristics of ARM instruction set. [7+8]
- 8.a) List and discuss the features of OMAP Processor.
- b) What is a cache memory? What is its use in microcomputers? [7+8]

---ooOoo---

11. Case study presentations:

- **Project 1: DTMF Controlled Home Automation System Circuit**

The main principle of this circuit is to control appliances like light and fan using DTMF technology. DTMF encoder is present in your mobile and decoder is HT9107B IC. Mobile jack is connected at 1nf capacitor. Mobile jack consists of two wires (Red and black). Red wire is connected to the decoder IC and Black is grounded. When a button is pressed from mobile it generates a tone which is decoded by the decoder IC and it is sent to ATMEGA8 controller. Controller then checks for input and it produces the output according to the code written to it.

- **Project 2: Street Lights that Glow on Detecting Vehicle Movement**

Street lights are switched on depending on the intensity of the Sun light on LDR. If the intensity of Sunlight on light dependent resistor is low, its resistance value is high. This value increases and becomes high when it is completely in dark. This resistance value decides when the street lights are required to switch ON.

As the resistance value is maximum in the midnights, real time clock comes into the play. The controller checks peak time during which there is no traffic and switch OFF the lights. When there is any vehicle on the road, it is detected by the PIR sensor.

Whenever PIR sensor is detected it just indicates the microcontroller to switch on the street lights. Then lights are switched on for 2 to 3 minutes and switched off automatically.

12. Assignment Questions:

ASSIGNMENT: 1

SET:1

1. Data transfer instructions, Arithmetic and Logical Instructions, Branch Instructions
2. Draw and Explain the pin diagram of 8086 in minimum mode
3. Explain the Flag register of 8086.
4. Explain Memory segmentation
5. a) Write a program to copy value 1020 h into 6 memory locations starting from 3000h
b) Write a program to perform 16-bit multiplication and store the resultant into 4000h

SET:2

1. Explain the Addressing modes of 8086
2. String Manipulation Instructions
Rotate and shift Instructions
3. Draw and explain the pin diagram of 8086 in maximum mode.
4. Write a ALP for sorting of array having word data.
5. Explain the register organization of 8086.

SET:3

1. Write an ALP for conversion of packed BCD to ASCII.
2. Draw and explain the pin diagram of 8086 in minimum mode.
3. a) Write a program to copy value 1020 h into 6 memory locations starting from 3000h
b) Write a program to perform 16-bit multiplication and store the resultant into 4000h
4. Explain the physical memory organization of 8086.

SET:4

1. Explain the Addressing modes of 8086
2. Explain the string instructions.
3. Write an ALP for conversion of packed ASCII to BCD.
4. Draw and Explain Architecture of 8086.
5. Draw and explain the pin diagram of 8086 in minimum mode.

ASSIGNMENT: 2**SET:1**

1. Explain the USART architecture
2. Interfacing of ADC with 8086
3. Addressing modes of 8051
4. Explain counters and timers of 8051
5. Explain the Architecture of 8051

SET:2

1. Explain various operation modes of Timer-1 and Timer-0.
2. Explain the alternate functions of Port-0, Port-2 and Port-3.
3. Memory organization of 8051 & interrupts of 8051
4. Briefly discuss about the serial communication standards
5. Write a program to generate 2 kHz square wave using timer.

SET:3

1. Write a program to generate 2 kHz square wave using timer.
2. Explain about arm processor architecture
3. Explain about arm interrupts & exceptions
4. Explain about arm register set
5. Draw and explain Cortex processor architecture

SET:4

1. What is the difference between microprocessor and microcontroller? Give 8051 architecture
2. Explain the USART architecture.
3. Explain the memory organization of 8051.
4. Write a program to generate 2 kHz square wave using timer.
5. Addressing modes of 8051.

UNIT WISE QUESTIONS:**Unit:1**

- 1.a) Write an ALP to find the sum of number in the array of 10 elements.
- b) Explain the concept of segmented memory.
- 2.a) Define the term Macro's & Assembler directives.
- b) What is meant Physical Memory organization in 8086 microprocessor.
- 3.a) What is meant by register organization in 8086 microprocessor.
- b) Draw the flag register of 8086 microprocessor & explain function of each flag.
- 4.a) Explain about the minimum mode pins of 8086 microprocessor in detail..
- b) Explain the maximum mode pins of 8086 microprocessor in detail.
- 5.a) Explain the architecture of 8086 microprocessor with a neat sketch.
- b) Describe the assembler directives of 8086 microprocessor
 - i) DW ii) SEGMENT iii) PROC and ENDP iv) ASSUME v) DUP
6. Draw the pin diagram of 8086 microprocessor and explain each pin function in it.
7. Explain the interrupts in 8086 microprocessor and draw the interrupt structure.

Unit:2

1. Explain about TCON & TMOD special function registers with a diagram in 8051 microcontroller.
- 2.a) Draw & explain the following SFR's
 - (i) IE (ii) IP
- b) Draw the PSW of 8051 microcontroller.
3. Draw the internal architecture of 8051 microcontroller.
- 4.a) Describe about the memory organization in 8051 microcontroller.
- b) What is the function of port-3 of 8051.
- 5.a) Write an Overview of 8051 microcontroller
- b) Describe about the timer mode 0 with a neat sketch in 8051 microcontroller.
6. Mention about the programming of timer interrupts
7. Write short notes on external hardware interrupts

Unit :3

- 1.a) Draw the internal diagram of Keyboard interfacing to 8051.

b) Explain the concept of External RAM interfacing along with block diagram

2.a) Draw the internal diagram of LCD interfacing to 8051.

b) Explain the concept of External ROM interfacing along with block diagram

3. Explain about following protocols in serial communication

a) I2C b) USB

4.Explain about following protocols in serial communication

a) SPI b) UART

5.a) Write short notes on RAM and ROM.

b) Explain about the interfacing of ADC with 8051 microcontroller.

6.a) What is meant by ADC and DAC

b) Draw a neat sketch of DAC to be interfaced with 8051 microcontroller.

7.a) Explain about the architecture of UART to be connected to 8051 microcontroller.

b) Write short notes on serial communication standards.

Unit: 4

1.a) List features of ARM Processor.

b) Draw and explain the architecture of ARM processor.

2.a) Explain Interrupt vector table of ARM processor.

b) Draw the ARM core data flow model.

3.a) Define term Loading constants.

b) Explain about instruction set of ARM processor..

4.a) Write short notes on registers in ARM.

b) Mention about the program status register instructions in ARM processor.

5.a) Write short notes on current program status register in ARM.

6. What is the need of Thumb instruction set and explain its instructions.

7.a) Define conditional execution.

b) Briefly explain about pipeline and exceptions of ARM.

Unit: 5

1. List the features and applications of CORTEX family processors.
2. Explain CORTEX processor architecture along with block diagram.
3. Write the features and applications of OMAP processor..
4. Explain about Open Multimedia Application Platform (OMAP) architecture.
5. Mention external interfaces on Cortex processor.
6. Mention the features of low cost debug solution in CORTEX.
7. Briefly give the different families of versions in CORTEX & OMAP.

13.LISTOFTOPICSFORSTUDENTSEMINARS

- 7-Segment Display Interfacing
- RS-232
- Pin and Block diagram of 8086
- Applications of Microprocessors, Microcontrollers
- Role of Microprocessors in Embedded Systems
- Serial communication Techniques
- Timing diagram of 8051
- ARM Processor and its advantages
- Advanced ARM processor and its features with Applications

14.STEP/Course material in softcopy



Mpm c notes pdf.pdf

15. Expert Lectures with topics & Schedules

Expert Name	Topic	Schedule (Tentative)
Dr N D Tiwari	Addressing modes and Instruction set of Microprocessor and Microcontroller	8/10/2023
Dr N D Tiwari	ALP for Microprocessor	6/11/2023
Dr J L Divya Shivani	ARM Processor	14/12/2023

ACADEMIC PLANNER

Subject: ELECTRONIC MEASUREMENTS&INSTRUMENTATION

<u>S.NO</u>	<u>CONTENT</u>
(1) -	Preamble/Introduction
(2) -	Prerequisites
(3) -	Objectives and Outcomes
(4) -	Syllabus 1. CMREC-R22 2. GATE 3. IES
(5) -	List of Expert Details (Local/National/International with Contact details/Profile link/Blogs/their research Contribution towards the subject)
(6) -	Journals with min 5 ref paper for literature study
(7) -	Subject -Lesson plan
(8) -	Suggested Books (prescribed and References)
(9) -	Websites for self learning Resources like <i>www.geeksforgeeks.org, www.schools.com, Coursera,edX, Udemy, Khan Academy, NPTEL etc along Registration procedures)</i>
(10) -	Question Banks 1.JNTUH/Model papers 2.GATE
(11) -	Two case study presentations with Project / Product/ Model /prototypes/ Industrial applications.
(12) -	Assignment Question/Innovative Assignments sets.
(13) -	List of topics for students Seminars with Guidelines
(14) -	STEP/Course material in softcopy
(15) -	Expert Lectures with topics & Schedules(if any)

(1) - Preamble/Introduction:

Instrumentation is a technology of measurement which serves not only science but all branches of engineering, medicine, and almost every human endeavor. The knowledge of any parameter largely depends on the measurement. Measurement plays an important role in the context of the progressive metamorphosis of science and technology. The subject of measurement is crucial to advancements in the field of electronics.

(2) - Prerequisites:

This subject recommends the basic knowledge of electrical engineering and basic engineering mathematics.

(3) - Objectives and Outcomes:

The objectives of the course are to:

- It provides an understanding of various measuring system functioning and metrics for performance analysis.
- Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
- Understanding the concepts of various measuring bridges and their balancing conditions.
- Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

Course Outcomes:

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

- **Discuss** the static and dynamic characteristics of measurement system
- **Analyze** the AC and DC voltmeters and current meters also analyze the signal analyzers
- **Discuss** the different types of signal generators and oscilloscopes
- **Classify** and analyze the different types of transducers.
- **Design** the different types of bridges.
- **Demonstrate** the Measurement of Physical Parameters.

(4)-Syllabus - R22

UNIT – I

Block Schematics of Measuring Systems: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag.

Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

UNIT - II

Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators.

Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications

UNIT – III

Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines. Applications: Measurement of Time, Period and Frequency Specifications.

Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs

UNIT - IV

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hot wire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers, gyroscopes, accelerometers.

UNIT - V

Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.

Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure – High Pressure, Vacuum level, Temperature -Measurements, Data Acquisition Systems.

SYLLABUS - GATE

UNIT I

Basic indicating Instruments, Error Analysis and Measurement, Digital Voltmeters.

UNIT II

Sweep Frequency Generators

UNIT III

Cathode Ray Oscilloscope

UNIT IV

Transducers

UNIT V

Measurement of Resistance and A.C Bridges

SYLLABUS - IES

UNIT I

Basic indicating Instruments, Error Analysis and Measurement, Digital Voltmeters

UNIT II

Not Applicable

UNIT III

Not Applicable

UNIT IV

Transducers

UNIT V

Measurement of Resistance and A.C Bridges

(5) - List of Expert Details(Local/National/International with Contact details/Profile link/Blogs/their research contribution towards the subject)

The Expert Details which have been mentioned below are only a few of the eminent ones known Internationally, Nationally and Locally. There are a few others known as well.

INTERNATIONAL

1. Kaushallya (Kay) Adhikari
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NATIONAL

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2. Mrs. A. Ajitha,
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Phone No: 7780656031.

(6) - Journals with min 5 ref paper for literature study

1. EPJ Techniques and Instrumentation: Springer
<https://epjtechniquesandinstrumentation.springeropen.com/>
2. Development and Validation of Testing System for Automated Millimeter-Wave Phased Array Multi-Beam Near-Field Measurement | IEEE Journals & Magazine | IEEE Xplore
<https://ieeexplore.ieee.org/document/10123377>
3. A Digital Bridge Evaluation up to 100 kHz for Precision Impedance Measurements | IEEE Journals & Magazine | IEEE Xplore
<https://ieeexplore.ieee.org/document/10122488>
4. A data-driven soft sensor for mass flow estimation | IEEE Journals & Magazine | IEEE Xplore
<https://ieeexplore.ieee.org/document/10122147>
5. Electronic Measurement and Instrumentation- Research gate
https://www.researchgate.net/publication/342318778_Electronic_Measurement_and_Instrumentation

(7) - Subject -Lesson plan

S.NO	TOPIC TO BE COVERED	Sub-Topic	cumulative Lectures Required	Suggested Books	Remarks
UNIT-I					
1.	Introduction of measuring instruments	Need of instrumentation and measurement	L1	T2,R2,R4	
2.	Block Schematics Of Measuring Systems Performance Characteristics	Diagram	L2	T2,R1,R4	
3.	Static Characteristics	Accuracy, Precision, Resolution	L3	T2,R1,R4	
4.	Types of Errors	Gaussian Error	L4	T2,R1,R4	
5.	Dynamic Characteristics	Repeatability, Reproducibility, Fidelity, Lag	L5, L6	T2,R2,R4	
6.	Measuring Instruments: DC Voltmeters ,	Multirange Voltmeter	L7	T2,R1,R4	
7.	D'Arsonal Movement	Ammeter Loading Effect	L8		
8.	DC Current Meters, AC Voltmeters	Block Diagram	L9	T2,R1,R4	
9.	Ohmmeters	Series-Type, Shunt Type, Multi Range	L10	T2,R1,R4	
10.	Multi meters: Meter Protection, Extension of Range	-	L11	T2,R2,R4	
11.	True RMS Responding Voltmeters,	Block Diagram	L12	T2,R1,R4	
12.	Specifications Of Instruments	-	L13	T2,R1,R4	
UNIT-II					
13.	Signal Analyzers, AF	Types	L14	T2,R1,R4	
14.	HF Wave Analyzers	-	L15	T2,R1,R4	
15.	Harmonic Distortion	-	L16	T2,R1,R4	
16.	Heterodyne wave Analyzers	Applications	L17	T2,R1,R4	
17.	Spectrum Analyzers,	Characteristics, Applications, Factors	L18	T2,R1,R4	
18.	Power Analyzers	Communications Signal Analyzer, Logic Analyzers, Network Monitoring	L19, L20	T2,R1,R4	

		System			
19.	Capacitance-Voltage Meters	-	L21		
20.	Oscillators	Considerations in Choosing an Oscillator	L22	T2,R1,R4	
21.	Signal Generators: AF-,RF ,Signal Generator Sweep Frequency Generators,	-	L23	T2,R2,R4	
22.	Pulse and Square Wave Generators,	-	L24	T2,R1,R4	
23.	Function Generators, Arbitrary Waveform Generator, Video Signal Generators	Applications, Specifications.	L25	T2,R1,R4	

UNIT-III

24.	Oscilloscopes: Cathode ray tube, Block Schematic Of CRO	-	L26	T2,R1,R4	
25.	Time Base Circuits,	neon time base circuit	L27 L28	T1,T2,R2, R4	
26.	Lissajous Figures	-	L29		
27.	CRO Probes	Types of CRO Probes	L30	T2,R1,R4	
28.	High Frequency CRO Considerations	Limitations	L31	T2,R1,R4	
29.	Delay lines, Applications, Specifications.	Types	L32	T2,R1,R4	
30.	Special purpose oscilloscopes: Dual Trace CROs	Types of phosphors used for CRO screens	L33	T2,R1,R4	
31.	Dual Beam CROs	-	L34		
32.	Sampling oscilloscopes,	Vertical and Time Base	L35	T2,R2,R4	
33.	Storage oscilloscopes	Types	L36	T2,R1,R4	
34.	Digital Storage CROs	CRO Probes	L37	T2,R1,R4	

UNIT-IV

35.	Transducers: Classification, Strain gauges, , unbounded;	Factors That Affect the Performance of a Transducer, Applications	L38	T2,R1,R4	
36.	Bonded-Type Strain Gauges	Filament Construction, Temperature Effect	L39	T2,R1,R4	
37.	Special Resistance-	-	L40	T1,T2,R1,	

	Thermometers			R4	
38.	Digital Temperature sensing systems	-	L41	T1,T2,R1, R4	
39.	Piezoelectric Transducers, Variable Capacitance-Transducers	Advantages	L42	T2,R1,R4	
40.	Magnetostrictive Transducers	Types	L43		
41.	Force and Displacement Transducer,-	Potentiometer, Potentiometric Transducer, Loading Effect on a Potentiometer	L44	T2,R1,R4	
42.	Resistance Thermometers	Self-Heating, Advantages	L45	T2,R1,R4	
43.	Hotwire Anemometer	Types	L46	T2,R1,R4	
44.	LVDT	Applications, Load Cells	L47	T2,R1,R4	
45.	Thermocouple	Junction, Installation	L48	T2,R1,R4	
46.	Synchros	Microsyn	L49	T2,R1,R4	
UNIT-V					
47.	Measurement of Physical parameters: Flow Measurement, ,	-	L50	T1,T2,R1, R4	
48.	Displacement Meters		L51	T2,R3,R4	
49.	Wheat Stone Bridge,	Operation, Measurement Errors, Thevenin's Equivalent Circuit	L52	T2,R1,R4	
50.	Kelvin Bridge	Kelvin Double Bridge, Applications	L53	T2,R3,R4	
51.	AC Bridges	General Form of Bridge Circuit	L54	T2,R1,R4	
52.	Maxwell, Hay	Phasor Diagram	L55	T2,R1,R4	
53.	Liquid level –Measurement	Direct and Indirect Methods	L56	T2,R3,R4	
54.	Measurement of Humidity and Moisture	-	L57	T2,R1,R4	
55.	Velocity, Force, Temperature Measurements	Types	L58	T2,R1,R4	
56.	Pressure-High Pressure,-Vacuum level,	Manometers	L59	T2,R1,R4	

57.	Data Acquisition Systems.	-	L60	T2,R3,R4	

(8) - Suggested Books (prescribed and References)

TEXT BOOKS:

1. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbins, W. D. Cooper: PHI 5th Edition 2003.
2. Electronic Instrumentation: H. S. Kalsi – TMH, 2nd Edition 2004.

REFERENCE BOOKS:

1. Electrical and Electronic Measurement and Measuring Instruments – A K Sawhney, Dhanpat Rai & Sons, 2013.
2. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
3. Industrial Instrumentation: T.R. Padmanabham Springer 2009.
4. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.

(9) – Websites for self learning Resources like

www.geeksforgeeks.org, www.schools.com, Coursera,edx,Udemy, Khan Academy, NPTEL etc along Registration Procedures

1. <https://www.electricalvolt.com/2023/01/definition-of-accuracy-precision-resolution-range/>
2. <https://instrumentationtools.com/darsonval-movement/#>
3. <https://www.ques10.com/p/4645/explain-heterodyne-type-wave-analyzer-and-its-appl/>
4. https://onlinecourses.nptel.ac.in/noc23_ee105/preview
5. <https://www.coursera.org/learn/sensors-circuit-interface>
6. <https://www.elprocus.com/cro-cathode-ray-oscilloscope-working-and-application/>
7. <https://www.youtube.com/watch?v=r7XMje25BFM&list=PLwAOmydmnlw2xKoemZSGsupZFXAvtM0Iw>
8. <https://www.youtube.com/watch?v=8Zhufd64rGg>

(10) – Question Bank

1. JNTUH/Model papers

Code No: 55023

R09

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, November/December - 2018

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 75

**Answer any five questions
All questions carry equal marks**

- 1.a) Explain in detail the various static performance characteristics
- b) Explain the working of D'Arsonval movementmeter with circuit diagram. [8+7]
- 2.a) With an example explain the working of successive approximation DVM.
- b) Write explanatory notes on square wave generators. [8+7]
3. Explain with a neat diagram the construction and working of HF wave analyser. [15]
- 4.a) Explain the construction of an AC bridge and derive the expression for unknown capacitance .
- b) Write short notes on bridged T networks. [8+7]
- 5.a) Draw the block diagram of CRO and explain each block of CRO.
- b) How much voltage is required across two deflection plates separated by 1 cm to deflect an electron beam by one degree, if the effective length of the deflecting plates is 2 cms and the accelerating potential is 1000 V. [9+6]
- 6.a) What do you mean by multi-trace with respect to oscilloscopes.
- b) With a neat block diagram explain each block of a dual trace oscilloscope. [5+10]
- 7.a) What is transducer? Classify all the transducers in detail.
- b) Explain the working of Piezo electric transducers with a neat sketch. [7+8]
- 8.a) Explain any one method of measuring moisture.
- b) Explain the working of a typical transducers to measure flow of a liquid. [7+8]

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R16/R15/R13

Code No: 135CD/125AM/115AM

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, March - 2021

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

(R16-Common to ECE, CSE; R15-Electronics and Communication Engineering;

R13-Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

- 1.a) What are the Dynamic characteristics of measuring systems? Define them.
b) Explain the working of Average responding Voltmeters. [9+6]
- 2.a) Describe the different types of errors.
b) How could you extend the range of Voltmeter? Explain with an example. [7+8]
- 3.a) What is the need of spectrum analyzers?
b) Discuss about pulse and square wave generator. [6+9]
- 4.a) Describe the working of AF Signal generator.
b) Draw the block diagram Heterodyne wave analyzer and explain its working. [6+9]
- 5.a) How do you measure Period and Frequency using CRO? Explain.
b) Compare Dual Beam and Dual trace CROs. [6+9]
- 6.a) What are the elements CRT and describe the function of each element of it.
b) Draw the Block diagram of Digital storage CRO and explain function of each block. [7+8]
- 7.a) Explain the working principle of Synchros and mention its applications.
b) Describe the principles of operation of capacitive transducers and mention their applications. [7+8]
- 8.a) How do you measure humidity? Explain.
b) Draw the block diagram of Data Acquisition System and explain the function of each block. [7+8]

Code No: 135CD

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, September - 2021

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

- 1.a) List out the different DC Current Meters used in measuring instruments and explain any one in detail.
b) Explain the following terms in detail: [6+9]
(i) Repeatability (ii) Reproducibility
- 2.a) List out the different DC Voltmeters used in measuring instruments and explain any one in detail.
b) Two ammeters are joined in series in a circuit carrying 100 A. one ammeter has a resistance of 10000 ohm shunted by 0.10 ohm while the other ammeter has a resistance of 150 ohm shunted by 0.02ohm. If the shunts are interchanged what would be the readings of the instruments. [7+8]
- 3.a) What is AF oscillators and explain its operation along with circuit diagram.
b) Draw the circuit diagram of Digital Fourier Analyzers and explain its operation. [7+8]
- 4.a) Draw the circuit diagram of Sweep generator and explain its operation in detail.
b) Draw the circuit diagram of Frequency selective wave analyzer and explain its operation. [7+8]
- 5.a) Draw the circuit diagram of Sampling oscilloscope and explain its operation in detail.
b) Explain the concept of Storage oscilloscope along with circuit diagram. [7+8]
- 6.a) Draw the cross section view of CRT and explain the operation of CRT in detail.
b) Draw and explain the measurement procedure of Lissajous patterns with one example. [7+8]
- 7.a) List out different types of Strain Gauges used transducer and explain any one in detail.
b) Explain the Resistive position Transducer along with circuit diagram. [8+7]
- 8.a) Explain the principle and working of Ultrasonic Flow meters. Compare this with other types of flow measurements.
b) Describe briefly data acquisition system. [7+8]

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Code No: 135CD

R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, October - 2020

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

(Common to EEE, ECE, CSE)

Time: 2 hours

Max. Marks: 75

**Answer any five questions
All questions carry equal marks**

- 1.a) Draw the circuit for D.C current meter and explain its working.
b) What are the different types of errors found in a measurement? Explain all. [7+8]
2. Draw the circuit of an electronic multimeter and explain how DC and AC currents, Voltages and resistance are measured. [15]
3. Draw the block diagram of an RF spectrum analyzer and explain its working and also write its applications. [15]
- 4.a) Determine the dynamic range of a spectrum analyzer with a third-order intercept point of +40 dBm and noise level of -100 dBm.
b) How is broad band sweep frequencies generated using a sweep generator. [8+7]
- 5.a) Compare and contrast between analog and digital storage CROs.
b) Discuss the screen of a CRT and factors affecting the brightness of the display. [7+8]
- 6.a) Briefly discuss the procedure for making amplitude and time measurements on an oscilloscope.
b) Explain with neat sketches the time base generator in the CRO. [8+7]
- 7.a) How are passive transducers classified? Explain the principle of those transducers briefly.
b) With the help of a neat sketch explain working principle and applications of LVDTs. [8+7]
- 8.a) What are the significance of bridge circuit measurements over direct meter measurements?
b) Write a short note on the principle of Wheat stone Bridge. Give its limitations. [8+7]

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R16

Code No: 135CD

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, November/December - 2018

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

(Common to EEE, ECE)

Time: 3 hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A**(25 Marks)**

- 1.a) Explain the concept of Gaussian Error in detail. [2]
- b) List out the different types of Errors presented in measuring instruments. [3]
- c) What is Signal Generator? [2]
- d) List out the few applications of AF oscillator. [3]
- e) List out the different applications of CRO. [2]
- f) Explain the procedure how to Measurement of Time period of any wave in CRO. [3]
- g) What is Piezo electric effect? [2]
- h) Explain the importance of Thermocouples with one example. [3]
- i) List out the different Limitations of Wheatstone's Bridge in detail. [2]
- j) List out different flow measurement method. [3]

PART - B**(50 Marks)**

- 2.a) Draw the Ramp type Digital voltmeter and explain its operation in detail.
- b) A Voltmeter having a sensitivity of $60k/V$ reads $40V$ on a $100V$ scale when connected across an unknown resistor. The current through the resistor is $4mA$. Calculate the % of error due to loading effect. [5+5]

OR

- 3.a) Draw the Sketch and explain the principle and operation of True RMS measuring Thermocouple type Voltmeter.
- b) Define Fidelity? Explain the importance of Fidelity in measuring instruments in detail. [5+5]

- 4.a) Draw the circuit diagram of Spectrum Analyzers and explain its operation in detail.
- b) Draw the circuit diagram of Function Generator and explain its operation. [5+5]

OR

- 5.a) List out the different modes of operation of Harmonic Distortion Analyzers and explain any one mode in detail.
- b) What is Heterodyne and explain the operation of Heterodyne wave analyzer along with its circuit diagram. [5+5]

UNIT-I

1. What are the basic performance characteristics of a system?
2. What are the different types of static errors in a system?
3. What is the method used to calculate the errors in an instrument?
4. Describe the function of the DC-Voltmeter and multi range voltmeter and explain their operation?
5. Explain the working of solid state voltmeter?
6. Draw the block diagram of the measuring system and explain the function of each stage of this system?
7. Explain the types of test signals used in determining dynamic characteristics of measurements applied to a system.
8. What is ayrton shunt? Describe it with a neat sketch .specify its application?
9. Explain with a neat block diagram of a dual slope digital voltmeter?
10. Explain the constructional details and differentiate between Ohmmeter series type and shunt type. ?

UNIT-II

1. Describe the functioning of standard signal generator?
2. How can a sine and square wave be generated using signal generator?
3. Explain how a Function Generator works?
4. Explain the functioning of Random Noise Generator and explain the parameters of noise?
5. Explain Square and Pulse Generator?
6. What is the basic difference between a signal generator and an oscillator?
7. Discuss fixed and variable AF oscillator?
8. What are the precautionary measures to be taken in a signal generator application?
9. Draw the Block Schematic of AF Wave analyzer and explain its principle and Working?
10. What are the applications of wave Analyzer?
11. Explain the working of the harmonic distortion analyzer?
12. Draw the block Schematic of a Basic Spectrum Analyzer and explain its working?
13. With a neat sketch explain the working of a digital Fourier analyzer?
14. Differentiate between wave analyzer and harmonic distortion analyzer?
15. Explain the two types of spectrum analyzers?
16. Explain the terms
 - a. Distortion in a waveform
 - b. Distortion in a communication sign
17. Explain how distortion occurs during transmission of a waveform

UNIT-III

1. Explain about storage oscilloscope with block diagram?
2. Draw the block Diagram of a Dual Trace CRO and explain it?
3. Explain with Neat Block Diagram of Digital Storage oscilloscope?
4. Draw the simplified block diagram of the oscilloscope and explain in detail?
5. What are the difference between digital storage oscilloscope and conventional storage oscilloscope?

6. Explain the method of finding phase, frequency relation ship of two waveforms using Lissajous figures?
7. Explain the logic of a time base of a frequency counter?
8. Explain in detail about various types of attenuators?
9. Explain briefly the Basic Features of a CRT?
10. Explain about Triggered Sweep CRO?
11. Explain briefly about delay line in triggered sweep circuit?
12. Explain briefly about the Vertical amplifier and Horizontal deflecting system?
13. Explain the measurement of frequency using CRO?

UNIT-IV

1. What is transducer? Write the classifications of transducers?
2. What parameters should be considered in selecting a transducer?
3. What is the difference between photo emissive, photoconductive and photovoltaic transducers?
4. Explain working of semiconductor strain gauge and what are its specific advantages?
5. What is temperature coefficient of resistor? Explain in detail?
6. Explain Piezo-electric effect?
7. Compare RTD with thermister.
8. Explain briefly about poisons ratio?
9. Write short notes on resistive transducer?
10. Draw the different forms of metal foil strain gauges and explain their principles of operation?

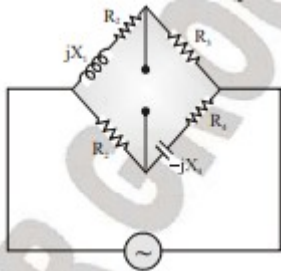
UNIT-V

1. Illustrate the principle of force summing devices using suitable examples and sketches?
2. Explain general Data Acquisition System (DAS) with a neat block diagram?
3. Show and explain the capacitive transducer arrangement to measure angular velocity and what are its limitations?
4. What are the main elements of velocity transducer?
5. Explain about Linear Variable Differential Transformer.
6. Explain spiral type bourdon tube?
7. Explain how pressure is measured using Piezoelectric transducer?
8. Briefly explain the working principles and measurement of force by any two nonelectric techniques?
9. Explain the working principle of potentio metric type accelerometer?
10. Explain the stroboscopic method of measuring the angular speed?
11. Draw the Maxwell's Bridge Circuit and derives the expression for the unknown element at balance?
12. Draw the Wien's Bridge Circuit and derives the expression for the unknown element at Balance?
13. Draw the Hay's Bridge Circuit and derives the expression for the unknown element at balance?
14. Draw the Wheat stone's Bridge Circuit and derives the expression for the unknown element at balance?
- 15.

(10.2) QUESTION BANK – GATE

1. A variable w is related to three other variables x, y, z as $w = xy/z$, The variables are measured with meters of accuracy $\pm 0.5\%$ reading, $\pm 1\%$ of full scale value and $\pm 1.5\%$ reading. The actual readings of the three meters are 80, 20 and 50 with 100 being the full scale value for all three. The maximum uncertainty in the measurement of w will be
(a) $\pm 0.5\%$ rdg (b) $\pm 5.5\%$ rdg (c) $\pm 6.7\%$ rdg (d) $\pm 7.0\%$ rdg

2. A moving coil of a meter has 100 turns, and a length and depth of 10 mm and 20 mm respectively. It is positioned in a uniform radial flux density of 200 mT. The coil carries a current of 50 mA, The torque on the coil is
 (a) 200 Nm (b) 100 Nm (c) 2 Nm (d) 1 Nm
3. A dc Ammeter is rated for 15 A, 250 V. The meter constant is 1.4,4 A-sec/rev, The meter constant at rated voltage may be expressed as
 (a) 3750 rev/kWh (b) 3600 rev/kWh (c) 1000 rev/kWh (d) 960 rev/kWh
4. A moving iron ammeter produces a full scale torque of 240 Nm with a deflection of 120° at a current of 10 A. The rate of change of self induction (H/radian) of the instrument at full scale is
 (a) 2.0 H/radian (b) 4,8 H/radian (c) 12.0 H/radian (d) 114.6 H/radian
5. An analog voltmeter uses external multiplier settings. With a multiplier setting of 20 k, it reads 440V and with a multiplier setting of 80 k , it reads 352V, For a multiplier setting of 40 k , the voltmeter reads
 (a) 371V (b) 383V (c) 394 V (d) 406V
6. An ammeter has a current range of 0.5 A, and its internal resistance is 0.2 . In order to change the range to 0-25 A, we need to add a resistance of
 (a) 0.8 in series with the meter (b) 1.0 in series with the meter
 (c) 0.04 in parallel with the meter (d) 0.05 in parallel with the meter
7. The bridge method commonly used for finding mutual inductance is
 (a) Heaviside Campbell bridge (b) Schering bridge (c) De Sauty bridge (d) Wien bridge
8. A bridge circuit is shown in the figure below. Which one of the sequence given below is most suitable for balancing the bridge ?



- (a) First adjust (b) First adjust (c) First adjust (d) First adjust

(11) - Two case study presentations with Project / Product/ Model /prototypes/ Industrial applications:

1. Performance Monitoring of Bridges through Instrumentation

Bridge engineers did not pay adequate attention to certain very vital aspects adversely affecting the serviceability condition and sometimes even jeopardize the safety of bridges. Some examples of these aspects which might be appropriately termed “Performance factors” are: the true stress conditions in the bridge components, serviceability factors such as deflection and cracking, actual stress and deformation conditions in the foundations, corrosion of reinforcing and pre-stressing steel, etc.

In recent years, the steadily increasing number of bridges, severely distressed owing to one or more of these factors acting over a period of time, has sharply brought home to engineers throughout the world to consider these factors in the design and construction of all major bridges. In India too, afflictions caused by some of these „performance factors“ have severely affected the health of several major bridges on our national and state highways.

2. A method to improve cathode ray oscilloscope accuracy

Distortion in cathode ray oscilloscopes limits the achieved accuracy in spite of piecewise linear correction. Polynomial functions for static and timebase nonlinearity corrections can achieve 4 to 5 times improvement inaccuracy compared to only about 2 times improvement for linear correction. For fast transient waveform recording this improvement is important in increasing dynamic range and decreasing waveform noise

(12) - Assignment Question sets:

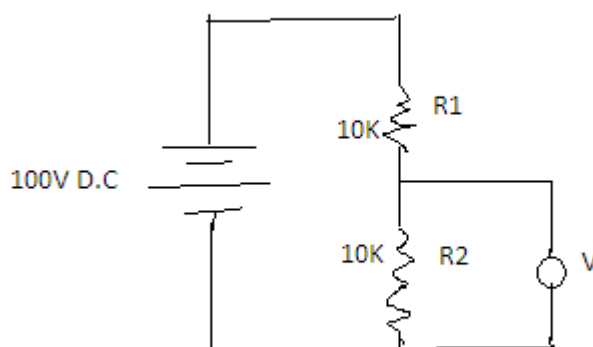
MID I

SET-1

1. A voltmeter having sensitivity of $15\text{K}\Omega/\text{V}$ reads 80V in its 100v scale when connected across an unknown resistance R_x . The current through the resistor is 1.8mA. Determine the % error due to loading effect. (CO1)
2. Design a basic DC-Voltmeter and multi range voltmeter and explain their operation? .(CO2)
3. Draw the block Schematic of a Basic Spectrum Analyzer and explain its working? (CO3)
4. Design a sine and square wave generator. (CO3)
5. Design a triangular wave generator. (CO3)

SET-II

1. In the circuit shown in the figure two resistors R_1 and R_2 are connected to a 100V D.C source. If the voltage across R_2 is to be measured by voltmeter having. (CO1)



- (i) A sensitivity of $1000\Omega/\text{v}$ and
- (ii) A sensitivity of $20,000\Omega/\text{v}$, then find which voltmeter will read the accurate value of voltage across R_2 . Both the meters are used on the 50V range

2. Design a universal ayrton shunt to provide an ammeter with a current range of 2A, 5A, 10A. Using a D'Arsonval movement with an internal resistance $R_m = 50 \text{ ohm}$ and full scale deflection current of 50 mA. (CO1)
3. Draw the Block Schematic of AF Wave analyzer and explain its principle and Working? What are the applications of wave Analyzer? (CO3)
4. Explain the method of finding phase, frequency relationship of two waveforms using Lissajous figures. (CO3)
5. Design a Wein bridge oscillator. (CO3)

MID II

SET-I

1. Explain about LVDT. (CO4)
2. Differentiate the digital storage oscilloscope and conventional oscilloscope. (CO3)
3. What is the principle of ultrasonic flow meters? Explain the operation of ultrasonic flow meter with neat Sketch (CO6)
4. A Maxwell bridge is used to measure an inductive impedance at a frequency of 3 KHZ. The Bridge constants at balance are 1: a capacitor of value $0.02 \mu\text{F}$ in shunt with $390 \text{ K}\Omega$; arm 3 opposite to the arm 1 is having the unknown component; the other arms have each $18 \text{ K}\Omega$ resistor. Find the equivalent series circuit of the unknown impedance., What is the value of the quality factor? (CO5)
5. Draw the block diagram of dual trace oscilloscope and explain the function of each block? (CO3)

SET-II

1. Write about the storage oscilloscope in detail. (CO3)
2. Write a small note on following one by drawing block diagrams a) Dual trace CRO b) Dual beam CRO c) Sampling CRO d) Digital storage CRO. (CO3)
3. write a small note on 1) Magneto strictive transducer 2) Piezo electric effect 3) Thermometers. (CO4)
4. Write about variable capacitive transducer in detail. (CO4)
5. Explain about double Kelvin's bridge method in detail. (CO5)

SET-III

1. (a) Explain LVDT. (CO4)
(b) Explain the classification of transducers with the help of examples. (CO4)
2. What are the applications of a piezo electric transducers, and Hot wire ammeter in Engineering measurements. (CO4)
3. Draw the neat sketch of the CRT and explain the main components of it. (CO3)
4. Explain with Neat Block Diagram of Digital Storage oscilloscope? (CO3)
5. Draw the block Diagram of a Dual Trace CRO and explain it? (CO3)

(13) - List of topics for students Seminars

1. Challenges in multiphase flow measurement.
2. Custody Transfer Metering.
3. Wireless Instruments - Challenges.
4. Vibration Measurement And Monitoring System

5. Application of instrument in navigations
6. Virtual Instrumentation
7. Mass flow Measurement
8. Infrared Temperature Measurement
9. Smart instruments

(14) - STEP/Course material in softcopy



1. Name the types of instruments used for making voltmeter and ammeter.

The types of instruments used for making voltmeter and ammeter are

- i. PMMC type
- ii. Moving iron type
- iii. Dynamometer type
- iv. Hot wire type
- v. Electrostatic type
- vi. Induction type.

2. State the advantages of moving iron type instruments.

The advantages of moving iron type instruments are:

- i. Less expensive
- ii. Can be used for both DC and AC
- iii. Reasonably accurate.

3. What are the basic performance characteristics of a system?

Ans:

STATIC CHARACTERISTICS

The static characteristics of an instrument are, in general, considered for instruments which are used to measure an unvarying process condition. All the static performance characteristics are obtained by one form or another of a process called calibration. There are a number of related definitions (or characteristics), which are described below, such as accuracy, precision, repeatability, resolution, errors, sensitivity, etc.

1. Instrument: A device or mechanism used to determine the present value of the quantity under measurement.
2. Measurement: The process of determining the amount, degree, or capacity by comparison (direct or indirect) with the accepted standards of the system units being used.
3. Accuracy: The degree of exactness (closeness) of a measurement compared to the expected (desired) value.
4. Resolution: The smallest change in a measured variable to which an instrument will respond.
5. Precision: A measure of the consistency or repeatability of measurements, i.e. successive readings does not differ. (Precision is the consistency of the instrument output for a given value of input).
6. Expected value: The design value, i.e. the most probable value that calculations indicate one should expect to measure.
- 7 Error: The deviation of the true value from the desired value.
8. Sensitivity: The ratio of the change in output (response) of the instrument to a change of input or measured variable.

(15) - Expert Lectures with topics & Schedules (if any)

S.NO	SUBJECT	TOPIC	YEAR	RESOURCE PERSON	DATE
1	EMI – EL01	Bridges - Wheat stone, Kelvin & Maxwell	III-I	Others	September 2024
2	EMI - EL02	Development of Cathode Ray Oscilloscope Tubes	III-I	Others	Oct,2024

**ACADEMIC PLANER
FOR
ACADEMIC YEAR
2024-25**

COURSE: III-YEAR-I-SEM, B.TECH, ECE

SUBJECT: Control Systems

CREDITS: 4

ACADEMIC PLANNER

Subject: Control Systems

S.NO

CONTENT

- (1) - **Preamble/Introduction**
- (2) - **Prerequisites**
- (3) - **Objectives and Outcomes**
- (4) - **Syllabus**

1. JNTU/Autonomous

2. GATE

3. IES

- (5) - **List of Expert Details** (Local/National/International with Contact details/Profile link/Blogs/their research Contribution towards the subject)

- (6) - **Journals with min 5 ref paper for literature study**

- (7) - **Subject -Lesson plan**

- (8) - **Suggested Books (prescribed and References)**

- (9) - **Websites for self learning Resources like**
(www.geeksforgeeks.org, www.schools.com, Coursera ,edX,

Udemy, Khan Academy, NPTEL etc along Registration procedures)

- (10) - **Question Banks**

1.JNTUH/Model papers

2. GATE

- (11) - **Two case study presentations with Project / Product/ Model /prototypes/ Industrial**

applications.

- (12) - **Assignment Question/Innovative Assignments sets.**

- (13) - **List of topics for students Seminars with Guidelines**

- (14) - **STEP/Course material in softcopy**

- (15) - **Expert Lectures with topics & Schedules (if any)**

1. PREAMBLE/INTRODUCTION:

This course introduces to the students the principles and applications of control systems in everyday life. The basic concepts of block diagram reduction, time domain analysis solutions to time invariant

systems and also deals with the different aspects of stability analysis of systems in time domain and frequency domain.

2. PREREQUISITES:

This subject needs requisite knowledge about mathematical fundamentals and applications of advanced mathematics like Laplace transform, differential equations and also network theory and basic electrical laws.

3. COURSE OBJECTIVE AND OUTCOMES:

Course Objective:

- To introduce different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form to interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.
- To employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions and identify the needs of different types of controllers and compensator to ascertain the required dynamic response from the system
- Formulate different types of analysis in frequency domain to explain the nature of stability of the system.

Course Outcomes:

At the end of the course, a student will be able to:

1. Categorize different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form.
2. Characterize any system in Laplace domain to illustrate different specification of the system using transfer function concept.
3. Interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.
4. Employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions.
5. Formulate different types of analysis in frequency domain to explain the nature of stability of the system.

PROGRAM EDUCATION OUTCOMES

- a. Graduates will demonstrate knowledge of mathematics, science and engineering.
- b. Graduates will demonstrate an ability to identify, formulate and solve engineering problems.
- c. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data.
- d. Graduates will demonstrate an ability to design a system, component or process as per needs and specifications.
- e. Graduates will demonstrate an ability to visualize and work on laboratory and multidisciplinary tasks.
- f. Graduate will demonstrate skills to use modern engineering tools, softwares and equipment to analyze problems.
- g. Graduates will demonstrate knowledge of professional and ethical responsibilities.
- h. Graduate will be able to communicate effectively in both verbal and written form.
- i. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
- j. Graduate will develop confidence for self education and ability for life-long learning.
- k. Graduate who can participate and succeed in competitive examinations.

PROGRAM OUTCOMES (POs)

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, social, 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 modelling 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 the engineering practice
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, 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 in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES(PSO'S)

1. Ability to apply concepts of Electronics & Communication Engineering to associated research areas of electronics, communication, signal processing, VLSI, Embedded systems
2. Ability to design, analyze and simulate a variety of Electronics & Communication functional elements using hardware and software tools along with analytic skills

Course Name: Control Systems (EC503PC)

EC503PC.1	Classify the control systems and concept of feedback in control systems.
EC503PC.2	Apply different rules and techniques to determine the transfer function of the block diagrams, signal flow graphs and mathematical models.
EC503PC.3	Analyze time response of different ordered systems. Also analyze the stability of the systems using R-H criterion & root locus techniques.
EC503PC.4	Determine the stability of the system using BODE plot, polar plot & Nyquist plot.
EC503PC.5	Develop the state models from block diagram.
EC503PC.6	Discuss the observability & controllability and compensator

CO-PO Matrix:

+	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC503PC.1	3	3	2	2		-	-	-	-	-	3	-
EC503PC.2	3	3	3	2	-	-	-	-	-	-	3	-
EC503PC.3	3	3	3	2	-	-	-	-	-	-	3	2
EC503PC.4	3	3	3	2	-	-	-	-	-	-	3	2
EC503PC 5	3	3	2	2	-	-	-	-	-	-	3	2
EC503PC 6	3	2	1	2	-	-	-	-	-	-	3	2

Course Outcome (CO)-Program Specific Outcome (PSO) Matrix:

Course Outcomes (CO's)	PSO1	PSO2
EC503P C.1	3	3
EC503PC. 2	3	3
EC503P C.3	3	3
EC503P C.4	3	3
EC503P C.5	3	3
EC503P C.6	2	2

SCOPE:

The scope of this subject is to provide an insight into the working and applications of advanced control system, digital signal processing, advanced digital signals processing, power systems, machine systems.

4. SYLLABUS:

UNIT-I Introduction to Control Problem: Introduction to Control Systems, Feedback Control Open-Loop and Closed-loop systems. Benefits of Feedback, Industrial Control examples Mathematical models of physical Systems, Control hardware and their models. Transfer function models of linear time-invariant systems, Block diagram algebra, Signal Flow Graph.

UNIT - II Time Response Analysis of Standard Test Signals: Time response of first and second order systems for standard test inputs Application of initial and final value theorem Design specifications for second order systems based on the time-response Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis Root-Locus technique, Construction of Root-loci.

UNIT - III Frequency-Response Analysis: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion - gain and phase margin closed loop frequency response.

UNIT - IV Introduction to Controller Design: Stability, steady-state accuracy transient accuracy, disturbance rejection insensitivity and robustness of control systems Root-loci method of feedback controller design specifications in frequency-domain. Frequency-domain methods of design Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs Analog and Digital implementation of controllers.

UNIT-V State Variable Analysis and Concepts of State Variables: State space model Diagonalization of State Matrix Solution of state equations Eigen values and Stability Analysis. Concept of controllability and observability Pole-placement by state feedback. Discrete-time systems Difference Equations. State-space models of linear discrete-time systems Stability of linear discrete-time systems

GATE SYLLABUS:

UNIT I

Basic control system components. Block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems.

UNIT II

Time domain specifications, Transient and steady state analysis of LTI control systems. Effects of proportional derivative and proportional integral systems. Root loci, Routh-Hurwitz criterion.

UNIT III

Bode plot, Polar and Nyquist plot.

UNIT IV

Control system compensators: elements of lead and lag compensation, Elements of Proportional-Integral-Derivative (PID) control.

UNIT V

State variable representation and solution of state equation of LTI control systems.

IES SYLLABUS:

UNIT I

Block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems, Effect of feedback on stability and sensitivity.

UNIT II

Transient and steady state response of control systems, Root locus techniques.

UNIT III

Concepts of gain and phase margin.

UNIT IV

Design of Control Systems, Compensators; Industrial controllers.

UNIT V

Not Applicable.

5. SUBJECT EXPERTS DETAILS:

REGIONAL:

1. Mr. Shyam, Dept. of ECE, IIIT, Nuziveedu.
Email : shyam2009p@gmail.com

NATIONAL:

1. I.J.Nagrath, Adjunct Professor and formerly deputy director
Birla Institute of technology and sciences Pilani (Rajasthan)

2. Dr.M.Gopal, Dept. of Electrical Engg., IIT, Delhi.
Email : mgopal.iitd.ac.in
3. Mr. A.Nagoor Kani, 52, Seshachalam Street, Saidapet, Chennai

INTERNATIONAL:

1. Mr.Katsuhiko Ogata, B.S., M.S., Ph.D.,
Deptt. Of Electrical and electronics engineering.

6. JOURNAL WITH MIN 5 REF PAPERS FOR LITERATURE SURVEY STUDY:

1. <https://researchgate.net/publication/266558068>

Title: An Evaluation of Adaptive Traffic Control System in Istanbul, Turkey

2. <https://folk.ntnu.no/skoge/prost/proceedings/ifac2014/media/files/2303.pdf>

Title: A control system for the individual route guidance in traffic flow networks

3. <https://journals.sagepub.com/doi/abs/10.1177/09596518211018298>

Title: Predictive control compensation for networked control system with time-delay

4. <https://ieeexplore.ieee.org/document/4389465?arnumber=4389465>

Title: Frequency Response Analysis of Active Disturbance Rejection Based Control System

5. <https://ieeexplore.ieee.org/document/5986332>

Title: Research on stability for linear control system with time delay

7. LESSON PLAN:

S.NO	JNTU syllabus	No. of Lecturers Required
UNIT-I		
1	Industrial Control examples	01
2	Mathematical models of physical systems	02
3	Control hardware and their models	01
4	Transfer function models of linear time-invariant systems	01
5	Feedback Control: Open-Loop and Closed-loop systems	03
6	Benefits of Feedback	01
7	Block diagram algebra, Signal Flow Graph	03
8	Problems	02
No. Of Classes Required		14
UNIT II		
9	Time response of first and second order systems for standard test inputs	02
10	Application of initial and final value theorem	02
11	Design specifications for second order systems based on the time-response	03
12	Concept of Stability, Routh-Hurwitz Criteria	03
13	Relative Stability analysis. Root-Locus technique	03
14	Problems	01
No. Of Classes Required		14
UNIT III		
20	Relationship between time and frequency response	01
21	Polar plots	03
22	Bode plots	03
23	Nyquist stability criterion. Relative stability using Nyquist criterion	03
24	Gain and Phase margin. Closed-loop frequency response	02
No. Of Classes Required		12
UNIT IV		
27	Stability, steady-state accuracy, transient accuracy, disturbance rejection	01
28	Insensitivity and robustness of control systems	01
29	Design specifications in frequency-domain	01
30	Frequency-domain methods of design	02
31	Application of Proportional, Integral and Derivative Controllers	01
32	Lead and Lag compensation in designs	02
33	Analog and Digital implementation of controllers	02
No. Of Classes Required		10
UNIT V		
40	State space model. Diagonalization of State Matrix	01
41	Solution of state equations. Eigen values and Stability Analysis	02
42	Concept of controllability and observability	02
43	Pole-placement by state feedback	01
44	Discrete-time systems. Difference Equations	02
	State-space models of linear discrete-time systems. Stability of linear discrete-time systems	02

No.Of Classes Required	10
Total No.Of Classes Required	61

8. SUGGESTED BOOKS:

TEXT BOOKS

- T1. Automatic Control Systems 8th edition-by B.C.Kuo 2003-John Wiley and son's.
- T2. Control Systems Engineering-by I.J.Nagrath and M.Gopal, New Age International (P) Limited, Publishers, 2nd edition.
- T3. Control Systems 1st edition-by Mr. A.Nagoor Kani , RBA Publications.
- T4. Control Systems Theory and Applications-S.SK.Bhattacharya
- T5. Control Systems-N.C Jagan-BS.Publications

REFERENCE BOOKS

- R1.Modern Control Engineering-by Katsuhiko Ogata-Prentice Hall of India Pvt.Ltd.,3rd edition,1998.
- R2. Control Systems by N.K.Sinha, New Age International (P) Limited Publishers, 3rd edition, 1998.
- R3. Control Systems Engg.by NISE 3rd Edition-John Wiley
- R4. "Modeling &Control Of Dynamic Systems" by Narciso F.Macia George J.Thaler, Thomson Publishers.

9. WEBSITES FOR SELF LEARNING RESOURCES:

- 1. NPTEL VIDEO LECTURES:
https://onlinecourses.nptel.ac.in/noc21_ee05/unit?unit=32&lesson=33
- 2. COURSERA:
<https://www.coursera.org/specializations/digital-signal-processing#howItWorks>
- 3. MIT OPEN COURSEWARE:
<https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-30-feedback-control-systems-fall-2010/lecture-notes/>
- 4. UDEMY:
<https://unacademy.com/lesson/introduction-to-gate-and-gate-control-systems/HNEZBQAK>

10. QUESTION BANK:



CSPREVIOUSQP.rar

11.CASE STUDY

Project 1:-

TITLE: - A New Method for Computing the Delay Margin for the Stability of Load Frequency Control Systems

Abstract:

Open communication is an exigent need for future power systems, where time delay is unavoidable. In order to secure the stability of the grid, the frequency must remain within its limited range which is achieved through the load frequency control. Load frequency control signals are transmitted through communication networks which induce time delays that could destabilize power systems. So, in order to guarantee stability, the delay margin should be computed. In this paper, we present a new method for calculating the delay margin in load frequency control systems. The transcendental time delay characteristics equation is transformed into a frequency dependent equation. The spectral radius was used to find the frequencies at which the root crosses the imaginary axis. The crossing frequencies were determined through the sweeping test and the binary iteration algorithm. A one-area load frequency control system was chosen as a case study. The impact of the proportional integral (PI) controller gains on the delay margin was investigated. It was found that increasing the PI controller gains reduces the delay margin.

Project 2:-

TITLE:- An improved stability criterion for linear time-varying delay systems

Abstract:

This paper considers the stability problem of linear systems with time-varying delays. A modified Lyapunov–Krasovskii functional (LKF) is constructed, which consists of delay-dependent matrices and double integral items under two time-varying subintervals. Based on the modified LKF, a less conservative stability criterion than some previous ones is derived. Furthermore, to obtain a tighter bound of the integral terms, the quadratic generalized free-weighting matrix inequality (QGFMI) is fully applied to different delay subintervals, which further reduces the conservatism of the stability criterion. Finally, three numerical examples are presented to show the effectiveness of the proposed approach.

12.ASSIGNMENT:

UNIT-I

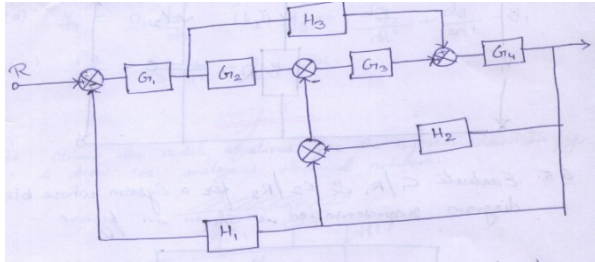
SET: 1

1. Explain open loop & closed loop control systems by giving suitable examples & also highlights their merits & demerits.
2. With suitable example explain the classification of control systems.
3. What are the characteristics of feedback?
4. Write the advantages and disadvantages of open loop and closed loop systems.

SET: 2

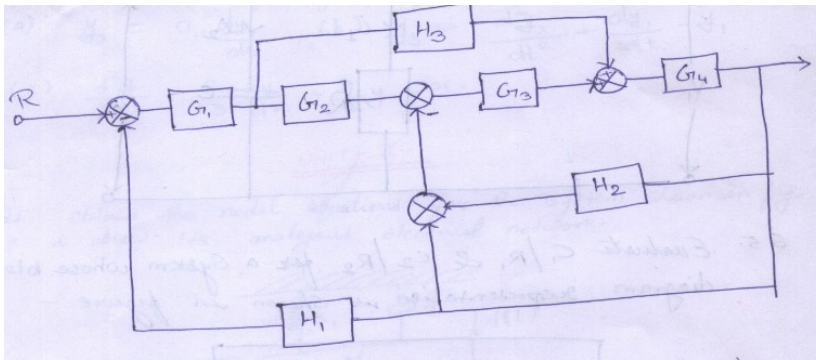
1. Explain the following terms
 - a. Transfer function
 - b. Open loop system
 - c. Closed loop system
 - d. Sensitivity
2. List out the limitations of open loop systems over a closed loop systems.

3. Give the advantages of feedback using feed control system.
4. Draw the Signal flow graph of the above system & verify the result by using Mason's gain formula

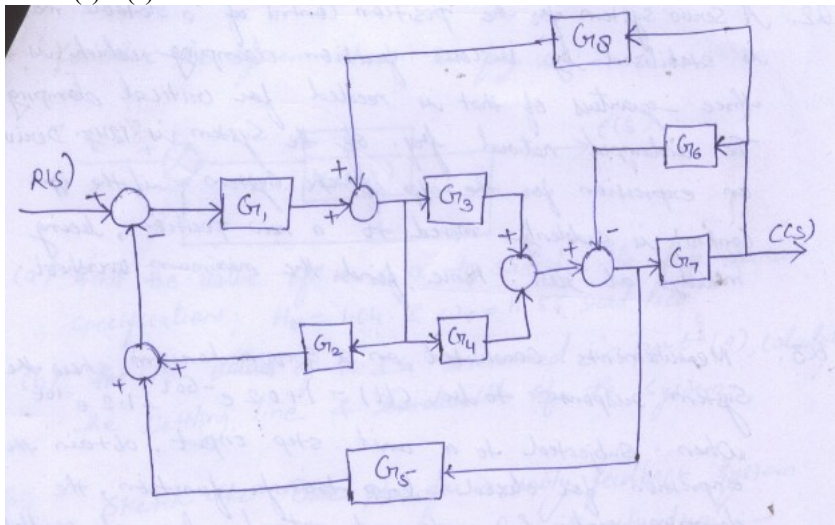


SET: 3

1. Explain the following terms
 - a. Transfer function
 - b. Open loop system
 - c. Closed loop system
 - d. Sensitivity
2. Draw the Signal flow graph of the above system & verify the result by using Mason's gain formula

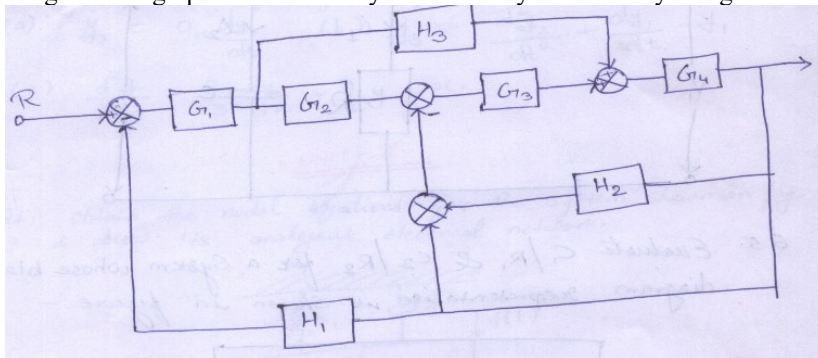


3. Distinguish between open loop and closed loop system.
4. Determine $C(s)/R(s)$

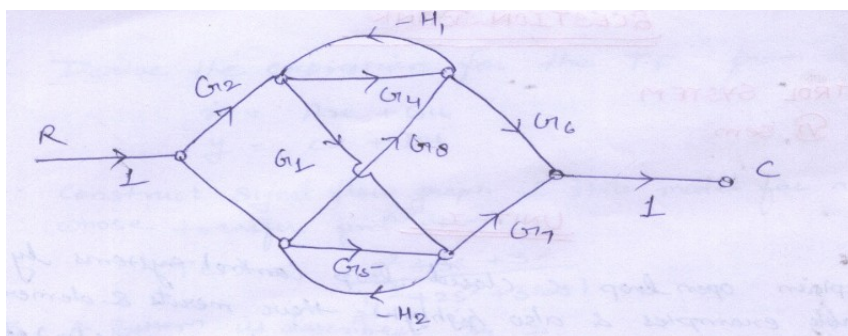


SET: 4

1. Explain temperature control system with neat block diagram?
2. What is mathematical model of a physical system? Explain briefly.
3. (a) Determine the overall transfer function (C/R) of the system shown in figure by block diagram reduction technique.
(b) Draw the Signal flow graph of the above system & verify the result by using Mason's gain formula



4. Use Mason's gain formula to find the transfer function $C(s)/R(s)$ for the signal flow graph shown below-



UNIT-II

SET: 1

1. For a unity feedback system whose open loop transfer function is $G(s) = 50/(1+0.1s)(1+2s)$, find the position, velocity & acceleration error constants.
2. A feedback control system is described as $G(s) = 50/s(s+2)(s+5)$, $H(s) = 1/s$ For a unit step input, determine the steady state error constants & errors.
3. The closed loop transfer function of a unity feedback control system is
Given by
Determine
(i) Damping ratio
(ii) Natural undamped resonance frequency
(iii) Percentage peak overshoot
(iv) Expression for error response.
4. Explain the specifications of time domain analysis.

SET: 2

1. Determine the step, ramp and parabolic error constants of the unity feedback control system. The open loop transfer function is following. $G(S) = 1000/(1+0.1S)(1+10S)$.
2. Obtain the unit ramp response of a unity feedback system, whose open loop transfer function is $G(S) = 5/S(S+4)$.
3. The open loop transfer function of a unity feedback control system is $G(S) = 100/S(1+0.1S)$. Determine the steady state error of the system when the input $r(t) = (2+5t)u(t)$.
4. Write the specifications of a second order system

SET: 3

1. Sketch the impulse response of a second order system when damping factor is
i) 0 ii) Between 0 and 1 iii) Greater than 1
2. What are the time response specifications? Explain each of them.
3. Explain error constants K_p , K_v , K_a for type I system.
4. Explain about peak time, maximum overshoot.

SET: 4

1. Explain about various test signals used in control system
2. Define time constant and explain its importance
3. Define the following terms
(i) Steady state error
(ii) Settling time
(iii) Type and order of control system
4. Derive the expression for some specifications of a standard second order system to a step input.

UNIT-III**SET: 1**

- 1.a) Write the necessary conditions for stability.
- b) Consider a sixth order system with the characteristic equation, $S^6 + 2S^5 + 8S^4 + 13S^3 + 20S^2 + 16S + 16 = 0$. Using Routh stability criterion, find whether the system is stable or not, give the reasons.
- 2.a) A unity feedback controlled system is characterized by open loop transfer function $G(S) = k(S+13)/s(S+3)(S+7)$ using Routh criterion calculate the range of value k for the system to be stable.
- b) Write the root locus of the system whose open loop transfer function is $G(S)H(S) = k/S(S+5)$.
3. a) The characteristic equation for certain feedback control systems is given below.
 $S^4 + 4S^3 + 13S^2 + 36S + k = 0$. Determine the range of K for the system to be stable.
- b) Write the important rules of root locus to construct.
4. Sketch the root locus plot of a unity feedback system with the open loop transfer function $G(S) = K/S(S+2)(S+4)$.

SET: 2

1. Sketch the root locus plot of a unity feedback system with the open loop transfer function $G(S) = K/S(S+3)(S+5)$.
2. Define the following terms
(i) Stable system
(ii) Critically stable
3. Define the following terms
(i) Absolute stability
(ii) Marginal stability
(iii) Conditional stability
4. State and explain Routh Hurwitz stability criterion

SET: 3

1. What are the difficulties in RH stability criterion? Explain how you can overcome them.
2. Explain the Routh's criterion to determine the stability of a dynamical system and give its limitations
3. What are the necessary conditions to have all the roots of the characteristic equation in the left half of s-plane?
4. Sketch the root locus plot of a unity feedback system whose open loop T.F. is

SET: 4

1. Write the root locus of the system whose open loop transfer function is $G(S)H(S) = k/S(S+5)$.
2. Write the important rules of root locus to construct.

3. The characteristic equation of a feedback control system is $s^3 + 4Ks^2 + (K+3)s + 10 = 0$.

apply the Nyquist criterion to determine the values of K for a stable closed loop System. Check the answer by means of the Routh Hurwitz criterion

4. Explain how Routh Hurwitz criterion can be used to determine the absolute stability of a system

UNIT-IV

SET: 1

1. a) For the given transfer function $G(S) = 10/(S+2)$. Sketch magnitude in dB VS frequency.
b) From the above plot calculate the following.
 - i) Gain crossover frequency.
 - ii) Actual magnitude at corner frequency.
2. a) Define gain crossover frequency, phase crossover frequency, gain margin and phase margin.
b) Sketch the Bode plot for the transfer function $G(S) = 10/S(S+5)$. Calculate gain crossover frequency.
3. Sketch the magnitude in dB vs. Frequency and phase vs. Frequency for the given transfer function $G(S) = 10(S+2)/S(S+5)$.
4. Sketch the Bode plot for the following transfer function and determine the system gain K for the gain cross over frequency !c to be 5 rad/sec.

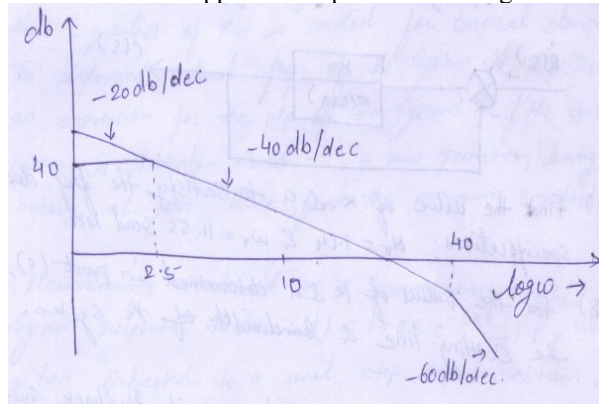
$$G(s) = Ks^2$$

SET: 2

1. Explain the following terms:
 - i. Frequency response
 - ii. Phase and gain margins.
2. Sketch the Bode plot for the following transfer function
3. Explain the following terms:
 - iii. Frequency response
 - iv. Phase and gain margins
4. Draw the Bode Plot for a system having $G(s)H(s) = 100/s(s+1)(s+2)$ Find
 - i. Gain Margin
 - ii. Phase Margin
 - iii. Gain Crossover freq.
 - iv. Phase crossover freq.

SET: 3

1. Draw the Bode Plot for the transfer function- $G(s) = 50/s(1+0.25s)(1+0.1s)$ From the plot determine Gain Margin & Phase Margin
2. Determine the transfer function whose approximate plot shown in figure



3. Define
 - (i) Minimum phase functions
 - (ii) Non-minimum phase functions
4. Define phase margin and gain margin

SET: 4

1. Sketch the polar plot for $G(S) = K/S(S+1)(S+2)$ and for what value of K it is stable
2. Enlist the steps for the construction of Bode plots.
3. Explain the procedure for determination of transfer function from Bode plots.
4. Sketch the Nyquist Plot for a unity feedback system having open-loop transfer function given by $G(s) = k/s(1+s)$

$$G(s) = k/s(1+s)$$

UNIT-V

SET: 1

1. State equation of a control system is given by-

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Obtain the state-transition Matrix.

2. A feedback system has a closed loop transfer function $10(s+4)/s(s+1)(s+3)$ Construct state model & its representation.
- 3.a) Explain state variable and state transition equation.
b) Describe the properties of state transition matrix.
4. Determine the state controllability & observability of the system described by

$$\dot{x} = \begin{bmatrix} -3 & 1 & 1 \\ -1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix} x + \begin{bmatrix} 0 & 1 \\ 0 & 0 \\ 2 & 1 \end{bmatrix} u$$
$$y = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} x$$

SET: 2

1. Define controllability and observability.
2. Evaluate the controllability of the system with the matrix.
3. Write the properties of state transition matrix.
4. Evaluate the observability of the system with the following matrices.

SET: 3

1. A feedback system has a closed loop transfer function $10(s+4)/s(s+1)(s+3)$
Construct state model & its representation
2. Construct signal flow graph & state model for a system whose transfer function is
 $T(s) = (s^2+3s+3)/(s^3+2s^2+3s+1)$
3. Determine the state controllability & observability of the system described by

$$\dot{x} = \begin{bmatrix} -3 & 1 & 1 \\ -1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix} x + \begin{bmatrix} 0 & 1 \\ 0 & 0 \\ 2 & 1 \end{bmatrix} u$$
$$y = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} x$$

4. State equation of a control system is given by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

SET: 4

1. Derive the Expression for the Transfer function from the state model
2. Construct signal flow graph & state model for a system whose transfer Function is $T(s) = (s^2+3s+3)/(s^3+2s^2+3s+1)$
3. Draw state transition signal flow graph for the following system By means of
(i) Parallel decomposition
(ii) Cascade decomposition
4. Write the properties of state transition matrix

ASSESSMENT PLAN FOR ACTIONS:

Assessment plan for Assignments:

Content	Weightage
Problems	60%
Descriptive	30%
Analytical/ Reasoning	10%

INNOVATIVE ASSIGNMENT QUESTIONS-MID-I

Set:1

1. On Teaching the Simplification of Block Diagrams (journal)
2. A journal in Control Engineering Practice -<https://www.journals.elsevier.com/control-engineering-practice/> (journal)
3. Perform a program for signal flow graph using MATLAB (program)
4. Explain all the methods to determine the stability of the system with examples. (Essay)
5. What are the types of the modeling of the systems & explain them with Examples (Essay)

Set:2

1. Perform a program for simplification of the block diagram using MATLAB (program)
2. A journal in Control Engineering Practice -<https://www.journals.elsevier.com/control-engineering-practice/> (journal)
3. Analyze Time response of second order system with one example. (Analysis)
4. Study & Explain the Types of controllers (Essay)
5. Consider a unity feedback system with open loop TF, $G(s) = K/s(s+5)(s+11)$.
(a) Find the gain, K, for the uncompensated system to operate with 30% overshoot.
(b) Find the peak time and K_v for the uncompensated system. (Problem solving)

INNOVATIVE ASSIGNMENT QUESTIONS-MID-II

1. Write & simulate a MATLAB program for BODE PLOT. (Program)
2. Write & simulate a MATLAB program for Root Locus. (Program)
3. Properties of State Spaces and Their Applications (journal)
4. Study the Types of compensators & Explain with Examples (Essay)

5. Tuning a PID controller correctly can bring the set point closer to the constraint with reduced variability.-(PID Controllers) (journal)

Set:2

1. Write & simulate a MATLAB program for Polar PLOT. (Program)
2. Properties of State Spaces and Their Applications (journal)
3. Write & simulate a MATLAB program for Root Locus. (Program)
4. The Fig shows a unity feedback system with controller. System TF $G=1/s(s+1)$, sketch and compare the loci for a) $Gc=K$ b) $Gc=K/(s+2)$ c) $Gc=K(s+2)$ (problematic)

5. Consider a unity feedback system with open loop TF, $G(s) = K/(s+3)(s+6)$

6. Design a lead compensator so that the system operates with a settling time of 2/3 second and a percent overshoot of 1.5. (Design)

13. LIST OF TOPICS FOR STUDENT'S SEMINARS:

1. Control Design of an Automated Highway System- http://www2.me.berkeley.edu/~horowitz/Publications_files/Papers_numbered/Journal/42j_Horowitz_Control_design_AHS_PIEEE00.pdf
2. Modern Control Techniques- http://daedalus.scl.sztaki.hu/diploma/Csercsik_David_2.pdf
3. Advances In Control System - <http://www.springer.com/in/book/9783540707004>
4. GSM Based Vehicle Theft Control System- <https://www.elprocus.com/gsm-based-vehicle-theft-control-system/>
5. Distributed Control Systems- http://solve.nitk.ac.in/dmdocuments/electrical/DCS_write_up.pdf
6. RFID enabled access control system- <http://www.ijcaonline.org/volume5/number11/pxc3871334.pdf>
7. PID controllers- http://home.hit.no/~hansha/documents/control/theory/tuning_pid_controller.pdf
8. ActuationAndControlSystem- http://cisb.org.br/wiefp2014/presentations/Session%206_Birgitta%20Lantto.pdf

14. STEP/COURSE MATERIAL:



CS LECTURE NOTES.rar

15. EXPERT LECTURE WITH TOPICS & SCHEDULES

S.NO	SUBJECT	TOPIC	YEAR	RESOURCE PERSON	DATE
1	CS	Frequency Response Plots	II-II	Others	25.06.2023

ACADEMIC PLANNER

FOR THE

ACADEMIC YEAR 2024-2025

COURSE: III YEAR B. TECH -I- SEM

Subject: Data Communications & Networks

CREDITS: 4

Presented by

B. Papachary, Assoc.Prof,

Dept.of ECE

ACADEMIC PLANNER

Subject: Data Communications and Networks

<u>S.NO</u>	<u>CONTENT</u>
(1) -	Preamble/Introduction
(2) -	Prerequisites
(3) -	Objectives and Outcomes
(4) -	Syllabus 1.R20-CMREC 2.GATE 3.IES
(5) -	List of Expert Details (Local/National/International with Contact details/Profile link/Blogs/their research Contribution towards the subject)
(6) -	Journals with min 5 ref paper for literature study
(7) -	-Subject -Lesson plan
(8) -	-Suggested Books (prescribed and References)
(9) -	-Websites for self learning Resources like <i>www.schools.com, Coursera Udemy, NPTEL etc along</i> Registration procedures -Question Banks 1. JNTUH/Model papers 2.GATE/IES
(11) -	Two case study presentations with Project / Product/ Model /prototypes/ Industrial applications.
(12) -	Assignment Question/Innovative Assignments sets.
(13) -	List of topics for students Seminars with Guidelines
(14) -	STEP/Course material in softcopy
(15) -	Expert Lectures with topics & Schedules (if any)

1. INTRODUCTION TO DATA COMMUNICATIONS AND NETWORKING:

- 1 Standards Organizations for Data Communications
- 2 Layered Network Architecture
- 3 Open Systems Interconnection (OSI)
- 4 Data Communications Circuits
- 5 Serial and parallel Data Transmission
- 6 Data communications Circuit Arrangements
- 7 Data communications Networks
- 8 Alternate Protocol Suites.

2. PREREQUISITES:

Digital Communications

3. COURSE OBJECTIVES :

1. To introduce the fundamentals of data communication networks
2. To demonstrate the functions of various protocols of the Data link layer.
3. To demonstrate the functioning of various Routing protocols.
4. To introduce the functions of various Transport layer protocols.
5. To understand the significance of application layer protocols

COURSE OUTCOMES:

Upon completing this course, the student will be able to

CO 1: Know the Categories and functions of various Data communication Networks

CO 2: Design and analyze various error detection techniques.

CO 3: Demonstrate the mechanism of routing the data in the network layer

CO 4: Know the significance of various Flow control and Congestion Control Mechanisms

CO 5: Know the Functioning of various Application layer Protocols.

4) SYLLABUS:



R22 B.Tech. ECE Syllabus

III YEAR B.TECH ECE-I SEM

L T/P/D C

3 1/0/- 4

Data Communications & Networks

UNIT - I: Introduction to Data Communications: Components, Data Representation, Data Flow, Networks- Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet - A Brief History, The Internet Today, Protocol and Standards - Protocols, Standards, Standards Organizations, Internet

Standards. Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol

Suite, Addressing Introduction, Wireless Links and Network Characteristics, WiFi: 802.11
Wireless LANs -The 802.11 Architecture,

Objective:

- Introduction to Data communication
- Different types of Network models, Interconnection of Networks
- Internet protocol, standards, and organizations
- OSI model
- TCP/IP model

UNIT - II: Data Link Layer: Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC, Multiple Access Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols.

802.11 MAC Protocol, IEEE 802.11 Frames

Objective:

- Introduction to Link layer
- Types of Errors and Redundancy
- Error correction and Detection
- Parity check, Cyclic Redundancy Check (CRC)
- Flow control and Error control protocols
- HDLC
- Random access, ALOHA
- MAC protocols

UNIT - III: The Network Layer: Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane, The Internet Protocol (IP): Forwarding and Addressing in the Internet- Datagram format, Ipv4 Addressing, Internet Control Message Protocol(ICMP), Ipv6

Objective

- Forwarding and Routing
- Virtual circuit and datagram Networks
- Concept of Router
- Queuing
- Internet protocol (IP)
- IPv4
- IPv6
- ICMP

UNIT - IV: Transport Layer: Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, GoBack-N(GBN), Selective Repeat(SR), Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control

Objective:

- Relationship Between Transport and Network Layer
- Multiplexing and Demultiplexing,
- UDP
- Reliable Data Transfer Protocol
- Go Back-N(GBN)
- Selective Repeat (SR)
- TCP
- Principles of Congestion Control

UNIT - V: Application Layer: Principles of Networking Applications – Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the File Transfer: FTP,- FTP Commands and Replies, Electronic Mail in the Internet- STMP, Comparison with HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works, DNS Records and messages

Objective:

- Principles of Networking Applications
- FTP
- Electronic Mail in the Internet
- STMP
- HTTP
- DNS

TEXTBOOKS:

1. Computer Networking A Top-Down Approach – Kurose James F, Keith W, 6th Edition, Pearson.
2. Data Communications and Networking Behrouz A. Forouzan 4th Edition McGraw-Hill Education

REFERENCES:

1. Data communication and Networks - Bhusan Trivedi, Oxford university press, 2016
2. Computer Networks -- Andrew S Tanenbaum, 4th Edition, Pearson Education
3. Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.

SYLLABUS – GATE:

Concept of layering: OSI and TCP/IP Protocol Stacks;
Basics of packet, circuit and virtual circuit-switching;
Data link layer: framing, error detection, Medium Access Control, Ethernet bridging;
Routing protocols: shortest path, flooding, distance vector and link state routing;
Fragmentation and IP addressing, IPv4, CIDR notation, Basics of IP support protocols (ARP, DHCP, ICMP), Network Address Translation (NAT);
Transport layer: flow control and congestion control, UDP, TCP, sockets;
Application layer protocols: DNS, SMTP, HTTP, FTP, Email.

SYLLABUS – IES:

Data link layer: framing, error detection, Medium Access Control, Ethernet bridging;
Routing protocols: shortest path, flooding, distance vector and link state routing;
Fragmentation and IP addressing, IPv4, CIDR notation, Basics of IP support protocols (ARP, DHCP, ICMP), Network Address Translation (NAT);
Transport layer: flow control and congestion control, UDP, TCP, sockets;
Application layer protocols: DNS, SMTP, HTTP, FTP, Email.

5. SUJECT EXPERTS DETAILS:

REGIONAL:

1. Dr N.S Murthy (NIT WARANGAL), Professor, Electronics & Com. Engg. Department
National Institute of Technology, Warangal - 506004, A.P, INDIA
E-Mail: nsm@nitw.ac.in
Phone No: 0870-2462404
2. Dr.Kakarla Subba Rao, *Dept. of ECE, CBIT, Gandipet, Hyd-75.*
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1. Dr. Ganapati Panda (IIT BHUBANESWAR),
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2. Goutam Saha(IIT KHARGHPUR), Associate Professor,
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<http://www.ecdept.iitkgp.ernet.in/index.php/home/faculty/gsaha>

INTERNATIONAL:

1. ***Behrouz Forouzan*** ,
emeritus professor of the Computer Information Systems department of DeAnza
College,
Phone: (408)864-8902
E-mail: forouzan@fhda.edu
2. **Andrew Stuart Tanenbaum**,

a Dutch-American computer scientist and professor emeritus of [computer science](#) at the [Vrije Universiteit Amsterdam](#) in the [Netherlands](#)..

www.cs.vu.nl/~ast

www.pearsonhighered.com/tanenbaum

2. Journals

IEEE Communications Surveys and Tutorials

<https://www.igi-global.com/journal/international-journal-business-data-communications/1087>

(7) . Lesson Plan

Name of the topic	Sub topics	No. of classes	Text books	Teaching Methods
UNIT I				
Introduction to Data Communications	Components, Data Representation	L1	T2,R1	M1
	Data Flow, Networks-Distributed Processing, Network Criteria, Physical Structures,	L2,L3	T2,R1	M1
	Network Models, Categories of Networks Interconnection of Networks	L4,L5	T2,R1	M1
	The Internet - A Brief History, The Internet Today, Protocol and Standards	L6,L7	T2,R1	M2:PP T
	Protocols, Standards Organizations, Internet Standards	L8,L9	T2,R1	M1
	Network Models, Layered Tasks,	L10,L11	T2,R1	M1
	OSI model, Layers in OSI model,	L12	T2,R1	M2:PP T
	TCP/IP Protocol Suite, Addressing Introduction	L13	T2,R1	M2:PP T
	Wireless Links and Network Characteristics,	L14 ,L15	T2,R1	M1
	WiFi: 802.11 Wireless LANs -	L16,L17	T2,R1	M1

	The 802.11 Architecture			
	No. of classes required: 17			
UNIT II				
Data Layer	Links, Access Networks	L18,L19	T1,R1,T2	M1
	LANs- Introduction to the Link Layer, The Services Provided by the Link Layer	L20,L21	T1,R1,T2	M1
	Types of errors, Redundancy, Detection vs Correction	L22	T1,R1,T2	M1
	Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks	L23,L24	T1,R1,T2	M1

	Check summing Methods, Cyclic Redundancy Check (CRC) , Framing	L25	T1,R1,T2	M2:PP T
	Flow Control and Error Control protocols	L26,L27	T1,R1,T2	M1
	Flow Control and Error Control protocols	L28,L29	T1,R1,T2	M1
	Noisy less Channels and Noisy Channels, HDLC, Multiple Access Protocols	L30,L31	T1,R1,T2	M1
	Random Access ,ALOHA, Controlled access, Channelization Protocols	L32	T1,R1,T2	M1
	802.11 MAC Protocol, IEEE 802.11 Frame	L33	T1,R1,T2	M1
	No. of classes required:16			
UNIT III				
The Network Layer	Introduction, Forwarding and Routing, Network Service Models,	L34,L35	T1,R1	M1
	Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks	L36,L37	T1,R1	M2:PP T
	Inside a Router-Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane	L38	T1,R1	M1
	The Internet Protocol(IP):Forwarding and Addressing in the Internet-	L39,L40	T1,R1	M1

	Datagram format, Ipv4 Addressing			
	Internet Control Message Protocol(ICMP), IPv6	L41	T1,R1	M1
	No. of classes required:08			
UNIT IV				
Transport Layer	Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet	L42,L43,	T1,R1	M1
	Multiplexing and Demultiplexing, Connectionless Transport: UDP - UDP Segment Structure, UDP Checksum	L44,L45	T1,R1	M1
	Principles of Reliable Data	L46,L47	T1,R1	M1

	Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, GoBack-N(GBN), Selective Repeat(SR)			
	Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management	L48, L49	T1,R1	M1
	Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control	L50, L51	T1,R1	M1
	No. of classes required:11			
UNIT V				
Application Layer	Principles of Networking Applications – Network Application Architectures,	L52, L53	T1,R1	M1
	Processes Communicating	L54	T1,R1	M1
	Transport Services Available to Applications,	L55	T1,R1	M1
	Transport Services Provided by the File Transfer	L56	T1,R1	M1
	FTP,- FTP Commands and Replies	L57	T1,R1	M1
	Electronic Mail in the Internet-STMP	L58	T1,R1	M2:PP T
	Comparison with HTTP	L59	T1,R1	M2:PP T
	DNS-The Internet's Directory Service	L60	T1,R1	M2:PP T

	Service Provided by DNS, Overview of How DNS Works, DNS Records and messages	L61, L62	T1,R1	M1
	No. of classes required:10			
	Total No. of Classes :54			

(8) SUGGESTED BOOKS:

TEXTBOOKS:

1. Computer Networking A Top-Down Approach – Kurose James F, Keith W, 6th Edition, Pearson.
2. Data Communications and Networking Behrouz A. Forouzan 4th Edition McGraw-Hill Education

REFERENCES:

1. Data communication and Networks - Bhusan Trivedi, Oxford university press, 2016
2. Computer Networks -- Andrew S Tanenbaum, 4th Edition, Pearson Education
3. Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.

9. WEBSITES and URL's:

1. VIDEO LECTURES:
<https://www.youtube.com/watch?v=sG6WGvzmVaw>
2. IIT Bombay CN VIRTUAL LAB:
http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php
- 3 .MIT OPEN COURSEWARE:
<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-263j-data-communication-networks-fall-2002/lecture-notes/>
4. TEXT BOOKS: [https://eclass.teicrete.gr/modules/document/file.php/TP326/%CE%98%CE%B5%CF%89%CF%81%CE%AF%CE%B1%20\(Lectures\)/Computer_Networking_A_Top-Down_Approach.pdf](https://eclass.teicrete.gr/modules/document/file.php/TP326/%CE%98%CE%B5%CF%89%CF%81%CE%AF%CE%B1%20(Lectures)/Computer_Networking_A_Top-Down_Approach.pdf)

10. Question Banks:

R18

Code No: 135AE

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

**B. Tech III Year I Semester Examinations, May/June - 2019
DATA COMMUNICATION AND NETWORKS
(Common to ECE, IT)**

Time: 3 hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries

10 marks and may have a, b, c as sub questions.

PART - A
(25 Marks)

- List out the topologies used in networks. [2]
- b) Differentiate circuit switched networks and datagram networks. [3]
 - c) Explain flow control. [2]
 - d) Describe the differences between PPP and HDLC. [3]
 - e) Differentiate broadcasting and flooding. [2]
 - f) Define tunneling. [3]
 - g) Differentiate between TCP and UDP. [2]
 - h) Why three way handshake is used in TCP. [3]
 - i) What is the use of FTP? [2]
 - j) What is the header format of HTTP reply message? [3]

PART - B
(50 Marks)

- 2.a) Explain the ATM reference model and describe the functions performed by each layer.
- b) What are the advantages and disadvantages of ring topology? [5+5]

OR

- 3.a) Elicit types of transmission media with their merits and demerits.
- b) Describe the characteristics of layered architecture. [5+5]

- 4.a) What are the different types of error detection methods? Explain the CRC error detection technique using generator polynomial $x^4 + x^3 + 1$ and data 11100011.
- b) Explain the CSMA schemes with diagrams. [5+5]

OR

- 5.a) Elucidate PCF and DCF in 802.11 format.
- b) A very heavily loaded 1 km long, 10-Mbps token ring has propagation speed of 200m/μsec. Fifty stations are uniformly spaced around the ring. Data frames are 256-bits, including 32 bits of overload. Acknowledgements are piggybacked onto the data frames and are included as spare bits within the data frames and are effectively free. The token is 8 bits. Is the effective data rate of this higher or lower than the effective data rate of a 10-Mbps CSMA/CD NETWORK? [5+5]
- 6.a) Differentiate DVR and OSPF.
- b) How count to infinity problem is resolved in DVR. [5+5]
- 7.a) Explain ARP and RARP with examples.
- b) What is purpose of ICMP? Explain its messages in detail. [5+5]
- 8.a) Explain the features and applications of UDP.
- b) Elucidate congestion control in datagram subnets. [5+5]
- 9.a) Elucidate the congestion prevention policies.
- b) Explain the TCP header fields in detail. [5+5]

- 10.a) What is an Electronic mail? Explain the two scenarios of architecture of E-Mail.
- b) Explain the architecture of WWW. Discuss client and server side functionality of this

architecture.

[5+5]

OR

11.a) What is SNMP? Briefly discuss the SNMP model components.

b) What is the use of DNS? Explain how it works?

[5+5]

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R18

Code No: 135AE

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, November/December - 2018

DATA COMMUNICATION AND NETWORKS

(Common to ECE, IT)

Time: 3 hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

- | | | |
|------|---|-----|
| 1.a) | List various components in a network. | [2] |
| b) | List and define different network topologies. | [3] |
| c) | Define bit stuffing and character stuffing. | [2] |
| d) | Briefly discuss about ALOHA. | [3] |
| e) | Why the class C is most commonly used Network class? | [2] |
| f) | Discuss how address mapping is performed. | [3] |
| g) | Mention Congestion Prevention Policies and how does it work. | [2] |
| h) | Flow control and Error control both are properties of Transport Layer and Data Link Layer. What you think is it duplicity of properties in both layer or is it ok? Comment. | [3] |
| i) | Define SNMP protocol. | [2] |
| j) | Discuss the properties of file transfer protocol. | [3] |

PART - B

(50 Marks)

2. With a neat diagram explain the OSI reference model in detail? Explain the functions performed in each layer. [10]

OR

3. What is multiplexing? Explain in detail about various types of multiplexing. [10]

4. Describe various error detection and correction technique. The generator polynomial is x^3+x+1 . A sender want to send data 1001. Generate CRC code. Also describe error checking process if 3rd bit is inverted from the left. [10]
OR
5. What is high level data link control (HDLC)? Explain HDLC frame format in detail. [10]
6. What is classful addressing? Discuss class A, class B, class C, class D, class E address with its range in decimal dotted notation and example. [10]
OR
7. Give an example to explain any one of the multicasting routing algorithm. [10]
8. Discuss the transport layer service primitives. What do you understand by 3 way hand shake Technique? Also discuss the TCP connection management. [10]
9. Compare and contrast between integrated services and Differential Services. [10]
10. Explain name – address and address – name resolution process. [10]
OR
11. Describe the various parts of e-mail address and show the process of sending and receiving e-mails. [10]

R18

Code No: 135AE

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B. Tech III Year I Semester Examinations, November/December - 2018
DATA COMMUNICATION AND NETWORKS
(ECE)

- 1 Answer the following: (10 X 02 = 20 Marks)
 - (a) Differentiate simplex and duplex communication systems.
 - (b) How data is represented in case of ASCII coding system?
 - (c) Describe the functions of session and application layers.
 - (d) Describe unipolar and bipolar signal representation codes.
 - (e) If the bit rate = 3000 and each signal element carries 6 bits. Find the baud rate.
 - (f) Differentiate between wireless LAN and Bluetooth.
 - (g) State modem specifications.
 - (h) Mention the QOS parameters of network service.
 - (i) What is congestion and how it occurs?
 - (j) Explain the principle of datagram.

PART-B

(Answer all five units, 5 X 10 = 50 Marks)

- 2 (a) What are the applications and advantages of data communication networks?
(b) Explain the classification of data communication networks.

OR

- 3 (a) What are the principles used in layer architecture?
(b) What are the merits and demerits of TCP/IP model over ISO OSI model?
- 4 (a) Describe various modes of data transmission.
(b) Explain the need for flow control in the data link layer.

OR

- 5 (a) What are the advantages of burst codes and how this is achieved?
(b) Discuss about error control protocol with diagram.
- 6 What are the differences between frequency division multiple access & code division multiple access and discuss them?

OR

- 7 Classify wireless LANs & wired LANs and give LAN standards.
- 8 Explain the various methods used by TCP for congestion control.

OR

- 9 (a) Describe the distance vector routing algorithm.
(b) Discuss IP addressing procedure and its advantages.
- 10 (a) List the transport layer's quality of service parameters and explain them.
(b) Under what conditions of delay, bandwidth, load and packet loss will TCP retransmit significant data unnecessarily.

OR

- 11 (a) How web security can be achieved? What are the different mechanisms?
(b) Explain the operation of any one authentication protocol with a neat diagram.

12. Assignment Question :

Unit -1

1. Explain how OSI and ISO related to each other are
2. Explain ISO/OSI reference model with neat diagram?

3. Define topology and explain and explain the topologies of networks?
4. Explain the transmission modes in details?
5. Define circuit switching networks in details?.
6. Define virtual circuit networks in details?

Unit-II

- 1.State the functions of MAC?.
2. How performance is improved in CSMA/CD protocol compared to CSMA protocol? Explain?
3. How CSMA/CA differ from CSMA/CD .explain in brief?. How performance is improved in CSMA/CD.
4. Discuss the MAC layer functions of IEEE 802.11?.
4. Discuss the MAC layer functions of IEEE 802.11?.
5. Explain the frames format ,operation and ring maintenance fracture of IEEE 802.5 MAC protocol

Unit-III

- 1.Explain network layer logical addressing?.
- 2.Illustrate internetworking and tunneling?.
- 3.Explain in details of ICMP,IGMP?
- 4.Explain uni-cast routing protocols in details?.
- 5.Explain multicast routing protocols in details?.

Unit-IV

- 1.Explain in detail about process to process delivery?.
- 2.Difference between UDP and TCP protocols?.
- 3.Illustrate the congestion control in details?.
- 4.Explain quality of services in switching networks?.
- 5.Explain data traffic congestion in detail?.

Unit-V

- 1.Explain in details of domain name space?.
- 2.Explain in details of electronic mails?.
- 3.Explain in details of SMTP?.
- 4.Explain in details of WWW?.
- 5.Explain in details of SNMP?.

13) List of topics for student's seminars:

- Biometric authentication and algorithms.
- Fuzzy Systems.
- Network Security.
- Scientific and Engineering Computing.
- Applications of Computer Science in Modelling.
- Neural Networks.

➤ Cryptography.

(14) - STEP/Course material in softcopy



DCN MATREILS.rar

15 . Expert Lectures & Schedules

Si No	Lecture Name	Dept	College	Contact no	Schedule s
1	Dr T. Pothalayya	ECE	VBIT	9966933132	Aug-2023
2	Dr K Pradeep Reddy	CSE	CMRIT	9848843987	Sept-2023

CO-PO Matrix:

Course Outcomes (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC603P C.1	3	3	2	2	-	-	-	-	-	-	3	-
EC603P C.2	3	3	3	2	-	-	-	-	-	-	3	-
EC603P C.3	3	3	3	2	-	-	-	-	-	-	3	2
EC603P C.4	3	3	3	2	-	-	-	-	-	-	3	2
EC603P C.5	3	3	2	2	-	-	-	-	-	-	3	2

Course Outcome (CO)-Program Specific Outcome (PSO) Matrix:

Course Outcomes (CO's)	PSO1	PSO2
EC603P C.1	3	3
EC603P C.2	3	3

EC603P C.3	3	3
EC603P C.4	3	3
EC603P C.5	3	3

