INTERNATIONAL ENGINEERING

UNDERGRADUATE PROGRAMME

REGULATIONS AND SYLLABI

2019

PSG INSTITUTE OF ADVANCED STUDIES

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PROGRAMME OFFERED

MECHANICAL ENGINEERING

- AUSTRALIA
- GERMANY
- UK
- US

COMPUTER SCIENCE ENGINEERING

- AUSTRALIA
- GERMANY
- UK
- US

INNOVATIVE TEXTILES

- GERMANY

MECHATRONICS ENGINEERING

- AUSTRALIA
- GERMANY
- UK
- US

ELECTRONICS AND COMMUNICATION ENGINEERING

- AUSTRALIA
- GERMANY
- UK
- US

CONTENTS

PSG INSTITUTE OF ADVANCED STUDIES

2019 REGULATIONS FOR (3+1 / 2+2 YEAR) BE/BS MECHANICAL / MECHATRONICS ENGINEERING / COMPUTER SCIENCE / BEng INNOVATIVE TEXTILES / ELECTRONICS AND COMMUNICATION ENGINEERING

(for the batches of students admitted in 2019 - 2020 and subsequently) *

NOTE: The regulations hereunder are subject to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of students (including those already undergoing the programme) as may be decided by the Academic Council and the partner institutions.

1. (a) PRELIMINARY DEFINITIONS AND NOMENCLATURE

In the following Regulations, unless the context otherwise requires

i) **"Programme"** means Degree Programme, that is **BE/BS Degree Programme.**

ii) **"Branch"** means specialization or discipline of BE / BS Degree Programme, like Mechanical / Mechatronics Engineering.

iii) **"Course"** means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, etc.

(b) CONDITIONS FOR ADMISSION

Students for admission to the BE / BS degree programme will be required to satisfy the conditions of admission thereto prescribed by the Partner Institutions.

2. DURATION OF THE PROGRAMME

i)a. **Minimum Duration:** The programme will extend over a period of four years leading to the Degree of BE/BS/BEng. The four academic years will be divided into eight semesters with two semesters per year. (2/3 years in India + 2/1 year in Partner Institution)

Each semester shall normally consist of 90 working days (or 450 hours or 540 periods of 50 minutes each).

3. UG PROGRAMMES OFFERED

The following are the branches of study under BE / BS / BEng degree programme.

BE / BS	Mechanical Engineering
BS	Mechanical Engineering Technology
BE	Mechatronics Engineering (Robotics and Automation)
BE	Computer Science Engineering
BEng	Innovative Textiles
BE	Electronics and Communication Engineering

4. STRUCTURE OF PROGRAMME

i. **Curriculum:** The curriculum will comprise courses of study as given in section I to V infra in accordance with the prescribed syllabi.

ii. **Summer Term Courses:** The courses under the title "Summer Term" shall be conducted for 4 weeks prior to the commencement of third semester during the summer. The evaluation of these courses will be done for 100 marks with full Continuous Assessment component and the pattern of evaluation will be as in 8(v) with single entry of marks for each component at the end of the course. The summer term courses will be evaluated by following absolute grading system discussed in sections 8(iii) infra. Students who fail to secure either 50% of total marks and, or the required attendance as in infra 5(i) shall be deemed to have failed in that course and shall appear as a supplementary candidate in the next semester examinations, the supplementary examination being conducted similar to supplementary examination for courses with full Continuous Assessment component.

iii. **Medium of instruction:** The medium of instruction, examinations, project report etc. shall be English.

5. REQUIREMENTS OF ATTENDANCE AND PROGRESS

i) A student will be qualified to appear for final examinations of any semester only if

a) he / she has satisfied the attendance requirements as per the norms given below:

- Minimum attendance of 90% overall in all theory and laboratory courses together.

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- However, a student who secures attendance between 80% and 90% in any course in the current semester due to medical reasons (hospitalization / accident / specific illness) or due to participation in the College / University / State / National / International level sports events with prior permission from Director shall be given exemption from the prescribed attendance requirement and he / she shall be permitted to appear for the current semester examinations.

- Students who secure less than 90% in any one of the courses or secure an overall attendance less than 90% will not be permitted to write the current semester examinations of all courses under any circumstances and not permitted to go to next semester.

b) his / her progress has been satisfactory and

c) his / her conduct has been satisfactory.

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Students who do not qualify to appear for final examinations of any semester for want of attendance and/or progress and/or conduct have to register for and redo that semester programme at the next immediate available opportunity.

6. PROCEDURE FOR COMPLETING THE PROGRAMME

i) The course work of the odd semesters will normally be conducted only in odd semesters and that of the even semesters only in even semesters.

ii) A student will be permitted to proceed to the courses of study of any semester only if he/she has satisfied the requirements of attendance, progress and conduct in respect of the preceding semester and had paid fees for that semester.

7. PROCEDURE FOR REJOINING THE PROGRAMME

A student who is required to repeat the study of any semester for want of attendance/ progress/conduct or who desires to rejoin the course after a period of discontinuance or who upon his/her own request is permitted by the authorities to repeat the study of any semester, may join the semester which he/she is eligible or permitted to join, only at the time of its normal commencement for a regular batch of students and after obtaining the approval from the DIRECTOR. No student will however be enrolled in more than one semester at any time. In the case of repeaters, the marks secured earlier in the repeated courses will be discarded.

8. ASSESSMENT AND PASSING REQUIREMENTS

i) **Assessment:** The assessment will comprise of Final Examination (FE) and /or Continuous Assessment (CA), carrying marks as specified in the scheme in section 8(v) infra. The CA marks will be awarded on assessing the student continuously during the semester as per guidelines 8(v) framed by the college. The assessment for theory courses carrying CA+FE or only CA (Full CA) will be done on absolute grading system. However, for the purpose of reporting the performance of a student, letter grades and grade points will be awarded as per section 8(iii)

ii) **Final Examinations:** Final examinations will normally be conducted during October / November and during March / April of each year. Supplementary examinations may be conducted at such times as may be decided by the college.

A student will be permitted to appear for the examination of a semester only if he/she has completed the study of that semester (vide section 5 supra). A student will not be allowed to register for final examination of any semester unless he/she simultaneously registers for the examinations of the highest semester eligible and all the courses which he/she be in arrears of.

A student, who is not permitted to appear at the final examination of a semester, is not permitted to proceed to the following semester.

A student, who is not permitted to appear at the final examination of any semester has to register for and redo the courses of that semester at the next available opportunity.

iii) **Letter Grade and Grade Point:** Each student, based on his / her performance, will be awarded a final letter grade and grade point as given in the table infra for each course at the end of each semester by following Absolute Grading System.

Absolute Grading System

In absolute grading system, the letter grade and grade points are awarded to each student based on the percentage of marks secured by him/her in Theory/ Laboratory courses as detailed below:

For UK/ AUSTRALIA/ GERMAN PARTNERSHIP PROGRAMMES

Range of percentage of total marks	Letter grade	Grade Point g
90 to 100	S	10
80 to 89	A	9
70 to 79	B	8
60 to 69	C	7
50 to 59	D	6
0 to 49 or less than 50% in final examination	RE	0
Withdrawal from examination	W	0

- "RE" denotes REDO in a course.

For USA PARTNERSHIP PROGRAMMES

Range of percentage of total marks	Letter grade	Grade Point g
90 to 100	A+	4.0
80 to 89	A	3.6
70 to 79	B+	3.2
65 to 69	B	2.8
60 to 64	C+	2.4
50 to 59	C	2
0 to 49 or less than 50% in final examination	RE	0
Withdrawal from examination	W	0

- "RE" denotes REDO in a course.

iv) **Passing a course:**

a. A student shall be deemed to have passed a theory course with (CA+FE) component. if

i) he/she secures at least 50% in the final examination paper and
ii) the total marks secured by him/her (CA+FE put together) is 50%

A student is deemed to have passed a Laboratory Course, **if** the total mark secured by him/her is at least 50%.

A student, who is absent for the final examination or withdraws from final examination or secures a letter grade **RE** (Grade point 0) in any course **including the summer term courses** has to register for supplementary examinations for all such courses at the next available opportunity and complete them.

b. A student, who absents or who withdraws or who secures a letter grade **RE** (Grade point 0) or less than 50% in final examination in any course carrying continuous assessment and final examination marks, will retain the already earned continuous assessment marks for the next immediate attempt only in the examination of that course and thereafter he/she will be solely assessed by final examination carrying the entire marks of that course.

A student, who absents or secures a letter grade **RE** (Grade point 0) in any course carrying only continuous assessment marks, will be solely examined by a final examination carrying the entire marks of that course, the continuous assessment marks obtained earlier being discarded.

c. A student who lacks in attendance or other serious deficiencies will have to register at the beginning of the subsequent semester, the CA mark already earned being not taken into account.

d. Supplementary Examinations: Examination in a course conducted as a regular examination for a batch of regular students and as a supplementary examination for a batch of other students.

v) **Scheme of Evaluation for Theory / Laboratory / Industrial Visit cum Lecture / Inplant Training Courses**

The under-mentioned categories of courses listed below will **carry 5 marks of CA** for course-wise attendance with official exemption as per the range of attendance % given below:

- Less than 90% 0 Mark
- 90% of attendance 3 Mark
- 91% to 95% of attendance 4 Marks
- 96% to 100% of attendance 5 Marks

a. Theory Courses (CA – 50% + FE – 50%) **Total: 100 Marks**

- **CA Distribution:**
  (i) Attendance 05 Marks
  (ii) Assignment* (Minimum 2) 10 Marks
  (iii) Tutorials/Presentation* (Minimum 2) 10 Marks
  (iv) Internal Tests: (Best 2 out of 3 Tests) 25 Marks
  [Scheduled by Academic Section]

- **Final Exam (FE)** 50 Marks

*Separate tutorial note books are to be maintained by the students for all such courses.

1. In regular tutorial classes, the students are to be guided to solve problems with faculty support.
2. Assessment Tutorials are open book tests, one each to be conducted, and evaluated as per the deadline for two assignment presentations and the marks entered (for senior classes).
3. In courses, where tutorial component is absent, 10 marks are to be allotted for mini projects etc, the deadline of mark entry being as above.
4. In respect of first semester and final year courses, the deadline for mark entry for tutorial & surprise quiz will be as per that of CA2 and CA3.

b. <u>Laboratory Courses (CA – 100%)</u> **Total: 100 Marks**

- **CA Distribution:**

(i) Attendance	05 Marks
(ii) Test /Record	40 Marks
• Test I / Record	15 Marks
Viva I	05 Marks
• Test II / Record	15 Marks
Viva II	05 Marks
(iii) Final Test (Full Portion) [scheduled by faculty concerned]	40 Marks
(iv) Viva by External Examiner	15 Marks

9. WITHDRAWAL FROM EXAMINATION

i) A student may, for valid reasons, be granted permission to withdraw from appearing for the examination in any course or courses of one semester examination if he/she does not have any history of arrears at the time of request for withdrawal. Prior permission for withdrawal from semester examinations is to be obtained from DIRECTOR. Also, only one application for withdrawal is permitted for that semester examination in which withdrawal is sought.

ii) Withdrawal application shall be valid only if the student is otherwise eligible to write the examination and if it is made prior to the commencement of the examination in that course or courses and also recommended by the Course Coordinator.

iii) A student shall be eligible for award of ranking only if he/she has passed the examination in first class or first class with distinction in the first available chance (i.e., first attempt in all the subjects). Those who have availed the provision of break of study / withdrawal will not be eligible for ranks.

10. TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

i) A student is not normally permitted to temporarily break the study. However, if a student intends to temporarily discontinue the programme in the middle for valid reasons (such as accident or hospitalization due to prolonged ill health) and to rejoin the programme in a later respective semester, he/she shall apply to the Director through the Coordinator and stating the reasons therefore.

ii) A student is permitted to rejoin the programme at the respective semester as and when it is offered after the break subject to the payment of semester fees and approval from the Director.

iii) if any student is detained for want of requisite attendance, progress and conduct, the period spent in that semester shall not be considered as permitted 'Break of Study'.

11. ENTRY REQUIREMENTS FOR 3rd and 4th YEAR OF STUDY @ PARTNER INSTITUTIONS

German Programmes:

a. PASS in all subjects (Semester 1 to 6)
b. TestDAF Score – 16 points (Max 4 points on each skill)
c. Valid Passport

University of HoF, German Programme:

a) PASS in all subjects (Semester 1 to 6)
b) German A1 and A2
c) Valid Passport

US Programmes:

a. PASS in all subject with Grades C and above
b. CGPA minimum 2.8/4 (Semester 1-6) (upto 4th Sem for 2+2 years)
c. TOEFL Score – minimum 80
d. Valid Passport

Australia Programmes:

a. PASS in all subject (Semester 1 to 4)
b. TOEFL / IELTS Score – minimum 80
c. Valid Passport

UK Programmes:

a. PASS in all subjects (Semester 1 to 6)
b. TOEFL / IELTS Score – minimum 80
c. Valid Passport

Students satisfying the entry requirements are eligible for admission in the fourth year, else need to repeat the year in PSG, until to achieve grade points required.

MECHANICAL ENGINEERING

COURSES OF STUDY AND SCHEME OF ASSESSMENT

Code No.	Course Title	Periods / week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	FE	Total
SEMESTER I								
19IM 101	Calculus and its Applications	3	1	0	4	50	50	100
19IM 102	Physics	3	0	0	3	50	50	100
19IM 103	Chemistry	3	0	0	3	50	50	100
19IM 104	Problem Solving and C Programming	2	2	0	3	50	50	100
19IM 105	English Language Proficiency	2	1	0	3	50	50	100
19IM 106	Concept of Engineering Design	3	0	0	3	50	50	100
19IM 110	Engineering Graphics I	0	0	4	2	50	50	100
19IM 111	Basic Sciences Laboratory	0	0	4	2	50	50	100
19IM 112	C Programming Laboratory	0	0	4	2	50	50	100
19IM 113	2D CAD Laboratory	0	0	2	1	50	50	100
19IH 071	Indian Language	2	1	0	3	50	50	100
19IG 065	German Language – A1	12	0	0	4	-	100#	100
SEMESTER 2								
19IM 201	Complex Variables and Transforms	3	1	0	4	50	50	100
19IM 202	Materials Science	2	0	0	2	50	50	100
19IM 203	Chemistry of Engineering Materials	2	0	0	2	50	50	100
19IM 204	Engineering Mechanics	3	1	0	4	50	50	100
19IM 205	Manufacturing Process I	3	0	0	3	50	50	100
19IM 210	Engineering Graphics II	0	0	4	2	50	50	100
19IM 211	Engineering Practices and Manufacturing	0	0	4	2	50	50	100
19IM 212	3D CAD Laboratory	0	0	2	1	50	50	100
19IM 214	Professional Skills	6	0	9	2	50	50	100
19IM 215	Internship – Summer Training	6	0	9	2	50	50	100
19IG 066	German Language – A2	12	0	0	4	-	100#	100
19IH 072	American History	2	1	0	3	50	50	100
SEMESTER 3								
19IM 301	Numerical Methods	2	1	0	3	50	50	100
19IM 302	Manufacturing Process II	3	0	0	3	50	50	100
19IM 303	Mechanics of Materials	3	0	0	3	50	50	100
19IM 304	Kinematics of Machinery	3	1	0	4	50	50	100
19IM 305	Engineering Thermodynamics	3	1	0	4	50	50	100
19IM 306	Economics for Engineers	3	0	0	3	50	50	100
19IM 310	Manufacturing Process Laboratory	0	0	2	1	50	50	100
19IM 311	Materials Science and Mechanics of Materials Laboratory	0	0	2	1	50	50	100
19IG 067	German Language – B1.1	12	0	0	4	-	100#	100
19IH 073	Organizational Behavior	3	0	3	3	50	50	100

SEMESTER 4								
19IM 401	Probability and Statistics	2	1	0	3	50	50	100
19IM 402	Basics of Electrical and Electronics Engineering	3	0	0	3	50	50	100
19IM 403	Fluid Mechanics	3	1	0	4	50	50	100
19IM 404	Dynamics of Machinery	3	1	0	4	50	50	100
19IM 405	Hydraulics and Pneumatics	2	2	0	3	50	50	100
19IM 406	Industrial Metallurgy	3	0	0	3	50	50	100
19IM 410	Machine Drawing	0	0	4	2	50	50	100
19IM 411	Electrical and Electronics Engineering Laboratory	0	0	2	1	50	50	100
19IG 068	German Language – B1.2	12	0	0	4	-	100#	100
19IH 074	TOEFL / IELTS Training	6	0	9	2	50	50	100
SEMESTER 5								
19IM 501	Design of Machine Elements	3	1	0	4	50	50	100
19IM 502	Thermal Engineering I	3	1	0	4	50	50	100
19IM 503	Operation Research	3	1	0	4	50	50	100
19IM 504	Tool Design	3	0	0	3	50	50	100
19IM 505	Manufacturing Automation	3	0	0	3	50	50	100
19IM 510	Fluid Machinery Laboratory	0	0	2	1	50	50	100
19IM 511	Thermal Engineering Laboratory	0	0	2	1	50	50	100
19IM 512	Manufacturing Automation Laboratory	0	0	2	1	50	50	100
19IM 513	PACE Laboratory	6	0	9	2	50	50	100
19IG 069	German Language – B2	12	0	0	4	-	100#	100
SEMESTER 6								
19IM 601	Design of Transmission Elements	3	0	0	3	50	50	100
19IM 602	Heat and Mass Transfer	3	1	0	4	50	50	100
19IM 603	Metrology and Instrumentation	3	0	0	3	50	50	100
19IM 604	Design for Manufacture and Assembly	3	1	0	4	50	50	100
19IM 605	Internet of Things for Mechanical Applications	3	0	0	3	50	50	100
19IM 610	Metrology and Dynamics Laboratory	0	0	2	1	50	50	100
19IM 611	Heat Transfer Laboratory	0	0	4	2	50	50	100
19IM 612	MATLAB	0	0	4	2	50	-	100
19IG 070	German Language – C1	12	0	0	4	-	100#	100

- German Language Exam will be conducted by Goethe Institute.
CA - Continuous Assessment, FE – Final Examination.

DETAILED SYLLABI

SEMESTER - 1

19IM 101 CALCULUS AND ITS APPLICATIONS

3 1 0 4

DIFFERENTIAL CALCULUS: Function of two variables, limits and continuity, partial derivatives, chain rule, extreme values and saddle points, Lagrange multipliers, Taylor's formula for two variables. (9 + 3)

INTEGRAL CALCULUS: Double integrals – double and iterated integrals over rectangles, double integrals over general regions, Fubini's theorem, area and volume by double integration, reversing the order of integration, polar form. (9 + 3)

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS: Basic concepts, separable differential equations, exact differential equations, integrating factors, linear differential equations, modeling - mixing problems, Newton 's law of cooling. (9 + 3)

SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS: Homogeneous linear equations of second order, homogeneous linear ODEs with constant coefficients, Euler– Cauchy equations, solution by variation of parameters, free oscillations ofmass-spring systems. (9 + 3)

VECTOR CALCULUS: Gradient and directional derivative of a scalar field, divergence and curl of a vector field. Integration in vector field – line integrals, path independence of line integrals, Green's theorem in the plane, divergence theorem of Gauss and Stokes 's theorems. (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Joel Hass, Christopher Heil, Maurice D.Weir. Thomas' Calculus, New Delhi: Pearson Education, 2018.
2. Erwin Kreyszig. Advanced Engineering Mathematics, New Delhi: Wiley India Pvt Ltd, 2015.

REFERENCES:

1. Howard Anton, Irl Bivens, Stephen Davis. Calculus, USA: John Wiley & Sons, INC, 2016.
2. Wylie C R and Barrett L C . Advanced Engineering Mathematics, New Delhi: Tata McGraw-Hill, 2019.
3. Michael D.Greenberg . Foundations of Applied Mathematics, New York: Dover Publications, INC, 2013.
4. Gilbert Strang. Calculus, USA: Wellesley Cambridge Press, 2017.

19IM 102 PHYSICS

3 0 0 3

MECHANICS : Introduction to vectors – velocity and acceleration vectors in two dimensions; Newton's laws of motion - mass, inertia and force, application of Newton's second and third laws in two dimensions - free body diagram, work done by a varying force, work-kinetic energy theorem; System of particles - center of mass in one and two dimensions; Rotational motion - radial and tangential acceleration, torque, rotation energy, conservation of angular momentum, gyroscopes and precession. (9)

OSCILLATORY MOTION AND WAVE MOTION: Oscillatory motion: Simple harmonic motion, spring mass system, torsional oscillator; Spring mass system - free, damped, forced oscillations and resonance; Wave motion: Plane progressive wave, attenuation of waves, differential equation and solution of a plane progressive wave, phase velocity, superposition of waves and group velocity. (9)

OPTICS : Review of Image formation by lenses, combination of thin and thick lenses; Chromatic and spherical aberrations, methods to reduce aberrations; Interference- superposition principle, intensity distribution, condition for interference, coherent and non-coherent sources, classification of fringes, system for observing interference phenomena, engineering applications - interferometric displacement measurement; Diffraction - Fraunhofer diffraction for single slit and double slit, diffraction grating, resolving power of a grating; Image formation system - optical microscope. (9)

HEAT : Heat transfer modes: Convection, conduction and radiation; Specific heat capacity; Coefficient of linear thermal expansion - measurement of thermal expansion - optical lever and dilatometry methods; Thermal stresses in composite structures due to non-homogeneous thermal expansion - applications in bimetallic strip, expansion gaps and rollers in engineering structures; Thermal conductivity - differential equation of one dimensional heat flow - Searle's apparatus and Lee's disc apparatus for determination of thermal conductivity - applications to refrigerators and ovens. (9)

ELECTROMAGNETISM: Review of definitions of fundamental terms; Permeability; Forces due to currents; Uniform and non-uniform magnetic fields; Static and time-varying magnetic fields; Electromagnetic induction - expression for induced emf; Electric fields - permittivity and dielectric displacement; Gauss theorem; Maxwell's equations and interpretation of Maxwell's equations; Electromagnetic waves - propagation of electromagnetic waves through isotropic media. (9)

Total L: 45

TEXT BOOKS:

1. Richard Wolfson. Essential University Physics, Singapore: Pearson Education, 2016.
2. Hugh D. Young, Roger A. Freedman, Lewis Ford. A. University Physics with Modern Physics, India: Pearson Education, 2008.

REFERENCES:

1. Halliday D, Resnick R, Walker J. Fundamentals of Physics, Wiley Publications, 2013.
2. Raymond A. Serway, John W, Jewett. Physics for Scientists and Engineers, Cengage Learning, 2017.
3. Paul A Tipler, Geene Mosca . Physics for Scientists and Engineers, New york: W.H.Freeman and Company, 2007.
4. Gaur R K, Gupta S L. Engineering Physics, Dhanpat Rai Publications, 2013.

19IM 103 CHEMISTRY

3 0 0 3

THERMODYNAMICS: Review of first law, variation of heat of reaction with temperature, adiabatic flame temperature; Joule Thomson effect and its significance- inversion temperature-liquefaction of gases; Second law- statements- entropy and spontaneity-free energy and spontaneity; Gibbs-Helmholtz equation; Concept of chemical potential-variation of chemical potential with T and P, Gibbs-Duhem equation, Clausius Clapeyron equation; Concept of fugacity and activity. (9)

PHASE EQUILIBRIA: Definitions, one component system (water), two component systems-Cu-Ni and Pb-Ag systems- lever rule; Solubility of gas in liquids- distribution law, principle of extraction, applications; Binary liquid systems-fractional distillation, azeotropic mixtures. (9)

KINETICS: Review of Integrated rate laws; Complex reactions: Opposing, parallel and consecutive reactions, steady state approximation- branched chain reactions, mechanism and kinetics of combustion of hydrogen and hydrocarbons. (9)

SURFACE CHEMISTRY: Adsorption: Freundlich and Langmuir adsorption isotherms, application of BET isotherm, applications of adsorption-abatement of air and water pollution, automobile catalytic converter; Surface active agents: Surfactants, detergents, emulsifiers, properties-critical miceller concentration, contact angle, wetting and water repellency. superhydrophobic surfaces. (9)

ELECTROCHEMISTRY: Electrode potential, emf series, standard and reference electrodes -SHE, calomel, Ag/AgCl; Nernst equation, galvanic and concentration cells, Ion selective electrodes-glass electrode-applications; Potentiometric and conductometric titrations; Applied Electrochemistry: Electroplating, electropolishing, electrochemical machining, electrophoretic painting, anodization of aluminium. (9)

Total L: 45

TEXT BOOKS:

1. Peter Atkins, Julio de Paula. Elements of Physical Chemistry ,6th Edition, UK: Oxford university press, 2013.
2. B.R. Puri, L.R. Sharma, M.S. Pathania . Principles of Physical Chemistry ,47th Edition, India: Vishal Publishing Company, 2017.

REFERENCES:

1. Donald A. McQuarrie, John D. Simon. Physical Chemistry: A Molecular Approach ,1st Edition, USA: University Science Books, 1997.
2. Derek Pletcher, Frank C. Walsh. Industrial Electrochemistry ,2nd Edition, London: Chapman and Hall, 1990.
3. J. Rajaram, J. C. Kuriakose. Thermodynamics for Students of Chemistry ,1st Edition, India: Shobanlal Nagin Chand Company, 1986.

19IM 104 PROBLEM SOLVING AND C PROGRAMMING

2 2 0 3

INTRODUCTION TO PROBLEM SOLVING: Program development - Analyzing and Defining the Problem - Algorithm - Flow Chart. (2+2)

PROGRAMMING LANGUAGES: Definition - Types of programming language – Modular Programming - Program Development Environment. (2+2)

C: The C character set - Identifiers and keywords - Data types – Constants - Variables - Declarations – Expressions - Statements - Operators & expressions - Arithmetic operators - Unary operators - Relational &

logical operators - Assignment operators - Conditional operators - comma operator – size of operator - Library functions - Data input & output functions. (4+4)

CONTROL STATEMENTS: If else - Switch Case - While - Do While - For - Nested loops - break – continue – goto statements. (4+4)

FUNCTIONS: Function prototype - Defining a function – function call - Passing arguments to a function - Storage classes - auto - static - extern and register variables.

(4+4)

ARRAYS: Defining an array - Processing an array - Passing array to a function - Multi dimensional array - Arrays & strings. (4+4)

POINTERS: Definition - Pointer Arithmetic - Pointer and arrays – Dynamic memory allocation. (2+2)

STRUCTURES AND UNIONS: Definitions - Processing a structure – Array and structures – Nested structures - Structures and pointers - Structures and functions.

(4+4)

FILES: Need for files – Operations on files - Sequential and Random-access file functions - File Handling Functions - Error handling functions. (2+2)

Preprocessor Directives - Command Line Arguments. (2+2)

Total: L: 30 + T: 30 = 60

TEXT BOOKS:

1. Herbert Schildt, “C: The Complete Reference”, McGraw Hill, 2010.
2. Rama N Reddy, Carol A Ziegler, “C Programming for Scientists and Engineers with Applications”, Jones and Bartlett, 2010.

REFERENCES:

1. Gottfried B,” Programming With C”, Tata McGraw Hill, 2009.
2. Deitel H M and Deitel P J, “C: How to Program”, Prentice Hall of India, 2005.
3. Kernighan B W and Ritchie D M, “C Programming Language (ANSI C)”, Prentice Hall of India, 2006.

19IM 105 ENGLISH LANGUAGE PROFICIENCY

2 1 0 3

LEARNING LANGUAGE THROUGH STANDARD LITERARY AND GENERAL TEXTS: Integrated tasks focusing on language skills; Training based on Text based vocabulary, tone, register and Syntax features (12 + 0)

GRAMMAR IN CONTEXT: Word Order; Subject Verb Concord; Style features - Tenses, Conditionals, Prepositions, Active and Passive Voice, Modals, Cloze and Spotting Error exercises

(10 + 0)

GUIDELINES FOR WRITTEN COMMUNICATION: Principles of clear writing, Paragraph writing, Essay writing, Emphasis Techniques, Summarizing and Paraphrasing, Analytical writing

(8 + 0)

FOCUS ON SPOKEN ENGLISH : Task – based activities: Graded levels of difficulty and with focus on language functions - Level 1: Self – expression – Greetings in Conversation, Hobbies, Special interests, Daily routine - Level 2: General Awareness – Expression of Concepts, Opinions, Social Issues, Description of a process / picture/chart, news presentation / review - Level 3: Advanced Skills – Making Short Speeches and Participating in Role Plays (0 + 10)

LISTENING ACTIVITY: Task based activities using Language Laboratory (0 + 5)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Faculty Incharge . Course Material on "English Language Proficiency, Coimbatore: PSG College of Technology, 2019.

REFERENCES:

1. Jill Singleton. Writers at Work: The Paragraph, New York: Cambridge University Press, 2012.
2. Simon Haines, Mark Nettle and Martin Hewing's. Advanced Grammar in Use, New Delhi: Cambridge University Press, 2008.
3. Anne Laws. Writing Skills, Hyderabad: Orient Black Swan, 2011.
4. Sinha DK. Specimens of English Prose, Hyderabad: Orient Black Swan, 2012.

19IM 106 CONCEPTS OF ENGINEERING DESIGN

3 0 0 3

VISUALIZATION AND FREEHAND SKETCHING: Understanding of form and functions, freehand sketching of typical engineering components (2)

ENGINEERING DESIGN: Engineering design process, Identification and analysis of needs, Organization of design concept, Modeling, Design Management, Information Gathering, Presentation Techniques, Rapid Prototyping. (5)

REVIEW OF MECHANICS: Force, torque, power, moment of inertia, bending moment, eccentric loading, friction, free body diagrams (7)

DESIGN PRINCIPLES: Occam's Razor, Saint-Venant's Principle, Golden Rectangle, Abbe's Principle, Maxwell's Reciprocity Theorem, Self-Principles, Stability, Symmetry, Parallel Axis theorem, Accuracy, Repeatability, Resolution, Sensitivity direction, Fool Proofing. (4)

STRESS AND STRAIN: Loading (elastic and plastic), stress, strain, Young's modulus, shear modulus, stress-strain curve (yield strength, ultimate tensile strength, proof strength, percentage elongation), tensile stress and shear stress computation, thermal stress, stress concentration factor, hoop stress, bending of beams, torsion of shafts, ductility, toughness, Hertzian contact stress, Fatigue (high-cycle, low-cycle), fracture mechanics (Initiation, Propagation, failure), springs-strain energy, bearings-an overview, theories of failure (14)

INNOVATION AND INVENTION SERIES: Creativity-development concepts, examples, Concept Evaluation, Mind Maps, TRIZ, Intellectual Property Rights. (5)

PLANNED EXPERIMENTATION THROUGH GRAPHICAL PROGRAMMING: Introduction, the front panel, the block diagram, data acquisition, components of a DAQ system, DAQ hardware configuration, DAQ assistant, analog I/O, digital I/O, typical sensor interface examples. (4)

GREEN DESIGN PROCESS: Material life cycle, Embodied energy, 80-20 rule, Carbon foot print, Green design in industry, Sustainability, Biomimetics (4)

PROJECT BASED LAB SESSIONS

- Assembly and dismantling of a bicycle / pneumatic cylinder
- Sensor Interface to monitor temperature by employing thermocouple using graphical programming
- Study of cut sections of automotive components
- CAD modeling of a typical engineering component using a CAD software
- Make a component / product

Total: L: 45

TEXT BOOKS:

1. Michael Ashby, Hugh Shercliff and David Cebon, "Materials Engineering, Science, Processing and Design", Elsiever, 2008.
2. Myer Kutz, "Environmentally Conscious Mechanically Design", John Wiley & sons, 2007.

REFERENCES:

1. LabVIEW: User Manual by National Instruments, 2010.
2. Faculty of Mechanical Engineering, "PSG Design Data Book", PSG College of Technology, 2010.
3. Jacob, Golden Berg, David Mazursky, "Creativity in Product Innovation", Cambridge University Press, 2002.
4. James Garrat, "Design and Technology", Cambridge University Press, 1988.

19IM 110 ENGINEERING GRAPHICS I

0 0 4 2

INTRODUCTION: Introduction to engineering drawing; Lettering practice, drawing instrument practice, Bureau of Indian Standards (BIS), geometric constructions, dimensioning practice as per BIS conventions.

ORTHOGRAPHIC PROJECTION: Principles of orthographic projection - projection of points, lines, planes and solids; Projection of simple engineering components and missing viewexercises.

PICTORIAL PROJECTIONS: Principles of pictorial views; Isometric views of simple engineering components; Free hand sketching of orthographic views from pictorial views; Free hand sketching of isometric views from orthographic views.

COMPUTER GRAPHICS: Introduction to solid modeling software, modeling of simple engineering components, extraction of 2D views from 3D models.

REFERENCES:

1. Venugopal K, Prabhu Raja V. Engineering Graphics, 15th Edition, New Age International Publishers, 2018.
2. John K.C. Engineering Graphics for Degree, PHI Learning Private Limited, 2009.
3. Bureau of Indian Standards. Engineering Drawing Practices for Schools and Colleges SP 46-2003, 15th Edition, BIS, 2003.
4. Shaw M.B, Rena B.C. Engineering Drawing, 11st Edition, Pearson Education India, 2009.

19IM 111 BASIC SCIENCES LABORATORY

0 0 4 2

PHYSICS (ANY EIGHT EXPERIMENTS):

1) Determination of Young's Modulus of a wooden bar – cantilever method
2) Determination of rigidity modulus of a given material using Torsion pendulum
3) Determination of thermal conductivity of bad conductor using Lee's Disc method
4) Determination of fiber thickness – air wedge method
5) Determination of wavelength of mercury spectrum using transmission grating
6) Measurement of vibration frequency of electrically maintained tuning fork using Melde's apparatus
7) Determination of Hysteresis loss of a ferromagnetic material
8) Determination of thermal conductivity of a metallic material using Wiedemann – Franz law
9) Determination of capacitance using LCR bridge
10) Determination of lattice constant using X-ray powder photograph
11) Demonstration Experiment 1: To determine the wavelength of the Ne Laser Using Michelson's Interferometer.
12) Demonstration Experiment 2: To determine the separation between the plates of Fabry Perot Etalon.

(30)

CHEMISTRY (ANY EIGHT EXPERIMENTS) :

1) Determination of rate constant of hydrolysis of an ester
2) Construction of eutectic phase diagram
3) Conductometric estimation of acid strength of a pickling bath
4) Electroplating of nickel and copper and determination of cathode efficiency
5) Anodizing of aluminium and determination of thickness of anodized film
6) Determination of kinematic viscosity of lubricating oil using Redwood viscometer
7) Determination of flash point and fire point of lubricating oil
8) Analysis of solid fuel by proximate analysis of coal
9) Mechanism of galvanic corrosion–determination of corrosion rate by corrosion current measurement
10) Estimation of hardness of water by EDTA method

(30)

Total P: 60

REFERENCES:

1. Department of Chemistry. Chemistry Laboratory Manual, 2019.
2. Department of Physics. Physics Practical's, 2019.
3. Wilson J. D. and Hernandez C. A. Physics Laboratory Experiments, New York: Houghton Miffin Company, 2009.

19IM 112 PROBLEM SOLVING AND C PROGRAMMING LABORATORY

0 0 4 2

1) Working with RAPTOR Tool – Flowchart Interpreter
2) Simple programs to understand Operators and expressions.
3) Decision making Statements: simple if, if. Else, nested if. else, else if ladder, switch case
4) Loops: while, do while, for

5) Implementation of one-dimensional array
6) Implementation of two-dimensional array
7) Working with Strings
8) Functions
9) Recursive functions
10) Structures: Arrays and Structures, Nested Structures
11) Structures and functions
12) Implementation of pointer and pointer arithmetic
13) Types of pointer: const pointer, pointer to a constant, void pointer, null pointer

(60)

Total P: 60

REFERENCES:

1. Deitel H. M. and Deitel P. J. C: How to Program, New Delhi: Prentice Hall of India, 2015.
2. Ajay Mittal. Programming in C - A Practical approach, New Delhi: Pearson, 2010.
3. Gottfried B. Programming with C, New Delhi: McGraw Hill Education, 2018.
4. Herbert Schildt . C: The Complete Reference, New Delhi: McGraw Hill, 2017.

19IM 113 2D CAD LABORATORY

0 0 2 1

Introduction to AutoCAD: History, Exploring GUI Workspaces, Co-ordinate systems, File Management: New, Qnew, Open, Save, save as, Close, Exit, Drawing settings: Units, Limits

Drafting settings: Ortho, Polar, Grid, Snap, Polar Tracking, Object snap, Dynamic Inputs, Quick Properties, Selection Cycling, Drawing Tools: Line, Circle, Arc, Ellipse, Polygon, Rectangle, Point, Multiline, Spline

Modify Tools: Erase, Oops, Undo, Redo, Explode, Move, Copy, Rotate, Mirror, Array, Align, Scale, Stretch, Lengthen, Trim, Extend, Break, Join, Chamfer, Fillet, Divide, Measure, Point Style, Mlstyle, Mledit, Pedit, Splinedit, Edit Array, Grip Editing, Hatching Objects: Hatch, Gradient, Hatchedit

Display Control: Zoom, Pan, Redraw, Regen, Clean Screen, Steering wheels, Object Properties: Color, Linetype, Ltscale, Line weight, Match Properties, Transparency, List

Dimension - Linear, Aligned, Radius, Diameter, Center Mark, Angle, Arc length, Continuous, Baseline, Tolerance, Dimension Space, Dimension Break, Jogged radius, Ordinate dimensions, Centre Mark, Centreline, Dimension Style, Dimension Edit, Annotation Tools: Leader, Qleader, Mleader, Mleader style, Add leader, Align Leaderlines, Collect Leader, Text, Style, Mtext, Scaletext, Spell, Table, Tablestyle, Tabledit

Parametric Modeling Geometric Constraint, Dimensional Constraint, Design Centre, Tool Palette, Introduction to plotting, Layout, Viewports, Mview, Page setup, Plot Styles, Plot

Total P: 60

REFERENCES:

1. Engineering graphics with Auto CAD 2018. Choudary/Anuradha Publishers.

SEMESTER – 2

19IM 201 COMPLEX VARIABLES AND TRANSFORMS

3 1 0 4

COMPLEX DIFFERENTIATION: Derivative, analytic function, Cauchy-Riemann equations, Laplace's equation, linear fractional transformations. (9 + 3)

COMPLEX INTEGRATION: Cauchy's integral theorem, Cauchy's integral formula, Laurent series, singularities and zeros, residue integration method (Residue integration of complex integrals only). (9 + 3)

LAPLACE TRANSFORMS: Laplace transform, linearity, first shifting theorem, transforms of derivatives and integrals, ODEs, unit step function, second shifting theorem, Dirac's delta function, periodic functions. (9 + 3)

FOURIER SERIES AND FOURIER TRANSFORMS: Fourier series – arbitrary period, even and odd functions, half range expansions. Fourier transforms, Fourier cosine and sine transforms. (9 + 3)

PARTIAL DIFFERENTIAL EQUATIONS: Basic concepts of PDEs, wave equation, heat equation, steady state two- dimensional heat problems, solution by separating variables and Fourier series. (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Erwin Kreyszig . Advanced Engineering Mathematics, New Delhi: Wiley India Pvt Ltd, 2015.
2. Wylie C R and Barret L C. Advanced Engineering Mathematics, New Delhi: Tata McGraw-Hill, 2019.

REFERENCES:

1. Dennis G Zill and Patrick D Shanahan. A First Course in Complex Analysis with Applications, New Delhi: Jones and Bartlett Pvt Ltd, 2015.
2. Mathews J H and Howell R W. Analysis for Mathematics and Engineering, New Delhi: Narosa Publishing House, 2012.
3. Peter V.O Neil. Advanced Engineering Mathematics, New Delhi: Cengage, 2016.
4. Dennis G Zill. Advanced Engineering Mathematics, New Delhi: Jones & Bartlett Pvt Ltd, 2017.

19IM 202 MATERIALS SCIENCE

2 0 0 2

CRYSTAL STRUCTURE: Unit cells and space lattices, crystal structures, crystal planes and directions, Miller Indices, coordination number, atomic packing factor of simple cubic, BCC, and FCC; Crystal imperfections – point, line, surface and volume imperfections. (6)

CERAMICS: Sintering, hot iso-static pressing, sol-gel process, chemical vapour deposition; Dielectric properties – dielectric constant, dielectric loss factor; Piezoelectric and pyroelectric properties; Mechanical properties – fracture toughness, strength of ceramics; Ceramic cutting tools; Thermal properties – thermal stress, thermal shock and thermal conductivity. (6)

POLYMERS: Crystallinity in polymers; Stress-strain behavior; Macroscopic deformation; Viscoelastic deformation – relaxation modulus, creep; Fracture of polymers, impact strength, fatigue and hardness; Deformation of semi-crystalline polymers; Factors influence the mechanical properties of polymers. (6)

PROCESSING OF COMPOSITE MATERIALS: Matrix and reinforcement, fibre properties – glass fibre, aramid fibre, carbon; Particulate and whisker reinforcements; Volume fraction and weight fraction; Metal matrix composite processing – solid and liquid state processes, Ceramic matrix composite processing – slurry and sol-gel methods, Polymer matrix composites processing - pultrusion and filament winding. (6)

PROPERTIES OF COMPOSITE MATERIALS: Micromechanics models for strength; Effect of reinforcement type, volume fraction on modulus and strength of metal matrix composites; Strength and toughness of zirconia reinforced alumina. Effect of coupling agent on strength of epoxy laminates, creep resistance of polymer matrix composites. Applications - aircraft engineering, space, wind turbines, sports equipment and automobiles.

(6)

Total L: 30

TEXT BOOKS:

1. Michel W Barsoum. Fundamentals of Ceramics, McGraw Hill Book Co, 2000.
2. Mathews F.L, Rawlings. Composite Materials and Science, Woodhead Publishing Ltd, 2002.

REFERENCES:

1. James F Shackelford. Introduction to Materials Science for Engineers, Pearson Prentice Hall, 2009.
2. Kingery W.D, Bowen H.K, Uhlmann D.R. Introduction to Ceramics, John Wiley and Sons, 2004.
3. Raghavan V. Materials Science and Engineering: A First Course, Prentice Hall of India Pvt. Ltd., 2015.
4. Derek Hull, T. W. Clyine. An Introduction to Composite Materials, Cambridge: Cambridge University Press, 2019.

19IM 203 CHEMISTRY OF ENGINEERING MATERIALS

2 0 0 2

FUELS AND COMBUSTION: Petroleum - refining, cracking and polymerization- petrol and diesel knocking-octane and cetane rating of fuels-reforming of gasoline. Coal- carbonization- coke manufacture-Otto-Hoffmann method. Synthetic petrol- Bergius process. Combustion of fuel-calorific value and theoretical air calculations. (6)

BATTERIES AND FUEL CELLS: Batteries- characteristics-construction and working of Lechlanche, lead-acid, nickel-cadmium and lithium-ion batteries- supercapacitors. Batteries for automobiles, satellites, torpedos, computer standby supplies. Fuel cell- theory, working principle and applications of proton exchange membrane, direct methanol fuel cells and solid oxide fuel cells.

(6)

CORROSION AND PROTECTIVE COATINGS: Forms of corrosion and their mechanism- galvanic, atmospheric, pitting, crevice and stress corrosion. Corrosion protection by design, cathodic protection, protective coatings, corrosion inhibitors - mention of types and applications.

(6)

MACROMOLECULES: Classification, molecular weight - Mn and Mw. Mechanism of polymerization- structure related to thermal, electrical and mechanical properties of polymers. Compounding of plastics, Moulding of plastics- compression, injection, extrusion and blow moulding techniques. Rubber – structure, vulcanization- fibre and carbon reinforced plastics, types of adhesives and sealants. (6)

MISCELLANEOUS MATERIALS: Lubricants-classification- properties, mechanism of lubrication-additives and improvers. Solid lubricants (graphite and MoS2). Abrasives: Natural abrasives (diamond and corundum)-synthetic abrasives (silicon carbide and boron carbide). Refractories-characteristics – classification –alumina, magnesite and zirconia bricks- applications. Boiler feed water- requisites -estimation of hardness-demineralization process. Nanomaterials and their applications-Graphene, CNT, ferrofluids. (6)

Total L: 30

TEXT BOOKS:

1. Shashi Chawla. A Text Book of Engineering Chemistry ,1st Edition, New Delhi: Dhanpat Rai and Company, 2005.
2. SS Dara, SS Umare. A Textbook of Engineering Chemistry ,20th Edition, India: S Chand and Company, 2010.

REFERENCES:

1. Sharma B. K. Engineering Chemistry ,1st Edition, Meerut: Krishna Prakashan Media (P) Ltd, 2005.
2. Mary Jane Shultz. Engineering Chemistry ,1st Edition, USA: Cengage learning, 2009.
3. P. C. Jain, M. Jain. Engineering Chemistry ,1st Edition, New Delhi: Dhanpat Rai Publishing Company, 2005.

19IM 204 ENGINEERING MECHANICS

3 1 0 4

STATICS OF PARTICLES AND RIGID BODIES : Particles: Forces on a particle, transmissibility, resultant of two forces and several concurrent forces - resolution of a force, equilibrium of a particle, free body diagram, force in space - equilibrium of a particle in space; Rigid bodies: External and internal forces, moment of a force, Varignon's theorem, moment of a couple, resolution of a force into a force and a couple - reduction of a system of forces, reactions at supports and connections. (10 + 4)

ANALYSIS OF STRUCTURES AND FRICTION: Structures: Simple trusses- method of joints, method of sections, joints under special loading conditions, space trusses and analysis of frames; Friction: Laws of dry friction, angles of friction, coefficient of static and kinetic friction, belt friction, wedges, journal bearings - axle friction, thrust bearings - disk friction, wheel friction - rolling resistance. (10 + 4)

CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA: Centroids of areas including composite areas, determination of moment of inertia of plane figures, polar moment of inertia, radius of gyration, mass moment of inertia of simple solids. (8 + 2)

KINEMATICS AND KINETICS: Kinematics: Planar, rectilinear and rotary motion, time dependent motions, rectangular coordinates, projectile motion; Kinetics: Equation of motion - Newton's II law, D'Alembert's principle; Energy: potential energy, kinetic energy, conservation of energy; Work done by a force, work energy method. (9 + 3)

IMPULSE AND MOMENTUM: Concept of conservation of momentum, Impulse-momentum principle, Non - impulsive forces; Impact: Direct central impact, oblique central impact, impact against fixed plane. (8 + 2)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Ferdinand P. Beer, E. Russell Johnston, David F.Mazurek, Philip J. Cornwell, Sanjeev Sanghi, Brian P. Self . Vector Mechanics for Engineers Statics and Dynamics ,10th Edition, New Delhi: McGraw Hill Education (India) Private limited, 2013.
2. Nelson. A. Engineering Mechanics -Statics and Dynamics, New Delhi: Tata Mcgraw-Hill, 2006.

REFERENCES:

1. Young D H, Timashenko S. Engineering Mechanics, New Delhi: Tata Mcgraw-Hill, 2006.
2. Rajasekaran S, Sankarasubramanian G. Engineering Mechanics-Statics and Dynamics, New Delhi: Vikas Publishing House Pvt. Ltd, 2006.
3. Bansal R K . Engineering Mechanics, New Delhi: Laxmi Publications Pvt. Ltd., 2006.
4. R.C. Hebler . Engineering Mechanics- Statics and Dynamics ,14th Edition , Pearson, 2016.

19IM 205 MANUFACTURING PROCESSES I

3 0 0 3

METAL CASTING: Casting terminology, hand moulding, pattern materials, allowances; Pattern types: Single piece, split, gated; Core prints, moulding sand properties, gating system, sprue, gate, riser; Melting practice: Cupola, crucible, induction furnaces; Casting defects; Special casting processes: investment casting, die-casting. (9)

JOINING PROCESSES: Gas welding: Flame types, equipment; Electric Arc Welding (EAW), Metal Inert-Gas (MIG) welding, Tungsten Inert-Gas (TIG) welding, types of electrodes, flux material; Resistance welding: Principle, spot, seam, lap welding; Welding defects; Modern welding processes: Laser beam, friction-stir welding; Soldering, brazing and adhesive bonding. (9)

SHEET METAL PROCESSES: Principle of shearing, punch-die clearance, shear on punch and die; Sheet metal operations: Blanking, punching, bending, drawing, spinning; Blanking force calculation; Die set: simple, progressive, compound; Press: open back inclinable press, hydraulic press; High energy rate forming processes: Explosive forming, electromagnetic forming, electro hydraulic forming. (9)

BULK DEFORMATION PROCESSES: Hot and cold working, principle of plastic deformation, principle of rolling, rolling mills, universal rolling and defects in rolled parts; Drawing: Wire and rod drawing; Forging: Open and closed die forging; Equipment: Pneumatic, drop hammers; Rotary swaging; Extrusion methods. (9)

POWDER METALLURGY AND PLASTIC PROCESSING: Production of metal powder: Atomization, crushing, blending; Compacting-die pressing, iso-static pressing; Sintering: Principle, continuous sintering process; Plastic processing: Injection moulding, blow moulding and rotational moulding. (9)

Total L: 45

TEXT BOOKS:

1. Rao P N . Manufacturing Technology (Volume 1) ,4th Edition, New Delhi: Tata McGraw Hill Education Private Limited, 2013.
2. Serope Kalpakjian and Stephen Schmid. Manufacturing, Engineering and Technology ,7th Edition, Pearson Education, 2018.

REFERENCES:

1. Mikell P Groover. Fundamentals of Modern Manufacturing: Materials, Processes, and Systems ,6th Edition , Wiley, 2015.
2. Arora R P . Manufacturing Technology, New Delhi: Macmillan India Limited, 2011.
3. Jain R K . Production Technology , Khanna Publishers, 2004.
4. HMT . Production Technology , Tata McGraw-Hill, 2002.

19IM 210 ENGINEERING GRAPHICS II

0 0 4 2

SECTIONS OF SOLIDS: Sections of regular solids, types of sections, BIS conventions, selection of sectional views; Sectional views of simple engineering components.

DEVELOPMENT OF SURFACES: Development of lateral surfaces of regular solids, truncated solids and simple engineering sheet metal components.

PERSPECTIVE PROJECTION: Principles of perspective projection, methods, perspective projection of solids and perspective projections of engineering components.

COMPUTER GRAPHICS: Modeling of engineering components using solid modeling software, preparation of drawings with sectional views.

REFERENCES:

1. Venugopal K and Prabhu Raja V. Engineering Graphics ,15th Edition, New Age International Publishers, 2018.
2. John K.C. Engineering Graphics for Degree, PHI Learning Private Limited, 2009.
3. Bureau of Indian Standards. Engineering Drawing Practices for Schools and Colleges, BIS, 2003.
4. Shaw M B and Rana B C. Engineering Drawing, Pearson Education India, 2009.
5.

19IM 211 ENGINEERING PRACTICES AND MANUFACTURING

0 0 4 2

CYCLE -1 (ENGINEERING PRACTICES):

1) Foundry: Study of tools; Preparation of mold using different types of patterns.
2) Welding: Study of arc welding tools and equipment; Exercises: Arc welding and TIG welding.
3) Fitting: Study of tools and operations; Exercises: Making of “L” Joint and “V” Joint.
4) Carpentry: Study of tools and operations; Exercises: Making of “L” Joint and “T” Joint.
5) Plumbing: Study of tools and operations; Exercises: External thread cutting and joining of PVC pipes.
6) Sheet metal work and Soldering: Study of tools and operations; Exercises: Making a rectangular tray.

(30)

CYCLE - 2 (LATHE):

1) Study of lathe: Specifications, constructional details, mechanisms, operations, cutting tools, work holding devices.
2) Machining a component using facing, chamfering and step turning operations.
3) Machining a component using taper turning and knurling operations.
4) Machining a component using step turning and grooving operations.
5) Machining a component using step turning and external thread cutting operations.
6) Machining a component using facing, drilling and boring.

(30)

Total P: 60

REFERENCES:

1. Department of Mechanical Engineering. Engineering Practices and Manufacturing Processes Laboratory Manual, PSG College of Technology, 2019.
2. Chapman WAJ. Workshop Technology, 2nd Edition, Edward Arnold, 2001.

19IM 212 3D CAD LABORATORY

0 0 2 1

INTERFACE/ SKETCHING: Exercises, creating a Sketch using sketcher toolbars- dimensioning – constrains-importing 2D drawings (10)

BASIC MODELING: Protrusion – Extrude- Single & double sided, Mirror, Rib- Chamfer, Fillet & shell. Holes -Standard & cut- Revolve. Creating datum planes, axes, curves, points, co – ordinate systems, Sweep-Blend- Patterns- straight, rotational & general (10)

ADVANCED MODELING: Variable section sweep, swept blend, Helical sweep etc. (5)

ASSEMBLING: Assembling the components – exploded state (5)

DRAWING: General view –projection view-detailed view –auxiliary view –revolved section view – dimensioning with geometric tolerances. (4)

SURFACE MODELING: Creating surfaces-open and close ends- merge tools- trim-intersection – conversion of surface to solids (6)

(40)

REFERENCES:

1. Engineering graphics with Auto CAD 2018. Choudary/Anuradha Publishers.

SEMESTER - 3

19IM 301 NUMERICAL METHODS

2 1 0 3

LINEAR ALGEBRAIC EQUATIONS: Errors - approximations and round-off errors - truncation errors - Gauss- elimination method, Crout's method, Gauss–Seidel method, eigenvalues and eigenvectors - power method. (6 + 3)

NONLINEAR EQUATIONS: False- position method, Newton-Raphson method, Bairstow's method. (6 + 3)

INTERPOLATION, DIFFERENTIATION AND INTEGRATION: Lagrange interpolating polynomials, equally spaced data-Newton 's forward and backward interpolating polynomials, numerical differentiation – evenly spaced data, numerical integration- Newton-Cotes formulae, Trapezoidal rule, Simpson 's 1/3 rule. (6 + 3)

NUMERICAL SOLUTION TO ORDINARY DIFFERENTIAL EQUATIONS: Taylor-series method, Euler method, 4th order Runge-Kutta method, multi-step method - Milne method. (6 + 3)

NUMERICAL SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS: Finite difference: elliptic equations - Laplace equation, Poisson equation – Liebmann method, parabolic equations – heat conduction equation – Crank Nicolson 's method, hyperbolic equations – vibrating string. (6 + 3)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Steven C Chapra and Raymond P Canale . Numerical Methods for Engineers , New Delhi: McGraw Hill Education, 2017.
2. Curtis F Gerald and Patrick O Wheatly . Applied Numerical Analysis , New Delhi: Pearson Education, 2017.

REFERENCES:

1. Richard L Burden, Douglas J Faires . Numerical Analysis , NewYork: Thomas Learning, 2017.
2. G. Miller . Numerical Analysis for Engineers and Scientists , UK: Cambridge University Press, 2014.
3. Amos Gilat and Vish Subramaniam . Numerical Methods for Engineers and Scientists - An Introduction with Applications using MATLAB , Wiley, 2014.
4. Ward Cheney and David Kincaid . Numerical Mathematics and Computing , USA: Cengage learning, 2018.

19IM 302 MANUFACTURING PROCESSES II

3 0 0 3

THEORY OF METAL CUTTING : Introduction: Material removal processes, types of machine tools; Metal cutting fundamentals: Theory of chip formation, types of chips, Piispanen model of card analogy, orthogonal cutting and oblique cutting; Nomenclature of single point cutting tools; Mechanics of metal cutting: Machining forces and Merchant's Circle Diagram (MCD) – simple calculations, cutting tool materials, tool wear, tool life, surface finish, cutting fluids; Overview of high speed machining. (10)

CENTRE LATHE AND CNC LATHES: Centre lathe, constructional features, cutting tool geometry, various operations, taper turning methods, machining time calculation; Capstan and Turret lathes; CNC turning centre: Constructional features, turret, LM guide ways, hydraulic chuck, ball screw, axes feed drive arrangement; Feedback devices: Linear encoder, rotary encoder. (9)

MACHINING USING OTHER MACHINE TOOLS: Reciprocating machine tools: Shaper, planer, slotter; Milling: Types of milling machines, up milling, down milling, milling cutters, operations; Constructional features of CNC machining centres; Drilling: Column and radial drilling machines, machining time calculations; Reaming, tapping and boring; Broaching machines: Push, pull broaching processes; Overview of work holding devices. (9)

ABRASIVE PROCESSES AND GEAR CUTTING: Abrasive processes: Grinding wheel designation and selection; Types of grinding processes: Cylindrical grinding, surface grinding, centreless grinding; Honing, lapping; Gear cutting: Forming, generation, shaping and hobbing; Cost comparison. (9)

NON-CONVENTIONAL MACHINING: Need, electric discharge machining (EDM), ultrasonic machining, laser beam machining (LBM), abrasive water jet machining (AWJM), electron beam machining (EBM), plasma arc machining (PAM), equipment, applications and limitations, cost comparison. (8)

Total L: 45

TEXT BOOKS:

1. Rao P N . Manufacturing Technology ,Volume 2 , McGraw-Hill Education, 2018.
2. Milton C Shaw . Metal Cutting Principles , Oxford: Clarendon Press, 1999.

REFERENCES:

1. Serope Kalpakjian and Stephen Schmid . Manufacturing, Engineering and Technology ,7th Edition , Pearson Education, 2018.
2. Mikell P Groover . Principles of Modern Manufacturing ,5th Edition , Wiley & Sons Pvt. Ltd, 2013.
3. Radhakrishanan P . Computer Numerical Control Machining and Computer Aided Manufacturing ,1st Edition , New Age International Publishers, 2010.
4. Anup goel . Manufacturing technology-II ,2nd Edition , Pune: Technical publication, 2011.

19IM 303 MECHANICS OF MATERIALS

3 0 0 3

CONCEPTS OF STRESS AND STRAIN: Axial and shear stresses and strains: Elastic limit, Hooke's law, lateral strain, Poisson's ratio, volumetric strain, relationship between elastic constants, factor of safety; Stepped bars, uniformly varying sections, stresses in composite bar due to axial force and temperature; Strain energy due to axial force: Proof resilience, stresses due to gradual load, sudden load and impact loads. (9)

BENDING MOMENT AND SHEAR FORCE: Relationship between load, shear force and bending moment; Shear force and bending moment diagrams: Cantilever, simply supported and overhanging beams subjected to concentrated load, uniformly distributed load, uniformly varying load, concentrated moments; Determination of maximum bending moment and point of contraflexure. (9)

BENDING STRESSES AND DEFLECTION OF DETERMINATE BEAMS: Theory of simple bending: Assumptions and derivation, section modulus, normal stresses due to bending; Deflection of beams: Governing differential equation using Macaulay's method and moment area method, application to simple problems. (9)

TORSION: Theory of torsion: Assumptions and derivation, polar modulus; Stresses in solid and hollow circular shafts, power transmitted by a shaft, design for torsional rigidity; Stresses and deflection in close coiled helical spring, springs in series and parallel.

(8)

THIN CYLINDERS, PRINCIPAL STRESSES AND STRAINS: Stresses in thin cylindrical and spherical shells subjected to internal pressure; State of stress at a point: Normal and tangential stresses on a given plane, principal stresses and their planes, plane of maximum shear stress - analytical method, Mohr's circle method, application to simple problems; Determination of principal stresses in a shaft subjected to bending, axial and torsional loads.

(10)

Total L: 45

TEXT BOOKS:

1. James M.Gere . Mechanics of Materials ,6th Edition, Thomson Learning, Inc, 2004.
2. Beer, Johnston & Dewolf . Mechanics of Materials, Tata McGraw-Hill Education, 2012.

REFERENCES:

1. Jindal U C . Textbook on Strength of Materials, Asian Books Pvt. Ltd., 2009.
2. Don H Morris, William F Riley and Leroy D Sturges. Mechanics of Materials, John Wiley and Sons Inc., 2007.
3. Russell C Hibbler . Mechanics of Materials ,10th Edition, Pearson, 2016.
4. Popov. E.P . Engineering Mechanics of Soilds , Prentice Hall, 1999.

19IM 304 KINEMATICS OF MACHINERY

3 1 0 4

BASICS AND SYNTHESIS OF MECHANISMS: Basics of mechanism: Terminology and definitions, kinematic pairs, degrees of freedom, Grashoff's law; Kinematic inversions: Four bar chain, slider crank chain, indices of merit; Synthesis of mechanisms: Type, number and dimensional synthesis: Graphical synthesis: Two, three position synthesis of slider crank, four bar mechanisms, analytical synthesis using Freudenstien's equation, precision positions, structural error, Chebyshev's spacing. (9 + 3)

KINEMATIC ANALYSIS: Displacement, velocity and acceleration analysis of simple mechanisms-graphical method, instantaneous centre method; Kinematic analysis of four bar linkages using loop closure equations, computer aided kinematic analysis of mechanisms.

(9 + 3)

GEARS AND GEAR TRAIN: Gear: Terminology and definitions, law of gearing, tooth forms, contact ratio, interference and undercutting; Gear trains: velocity ratio, simple, compound and epicyclic gear trains, holding torque. (9 + 3)

KINEMATICS OF CAM: Fundamentals of cam, classifications, displacement diagram, derivatives of uniform velocity, simple harmonic motion, cycloidal, uniform acceleration and retardation motion; Layout of cam profiles for different types of followers; Knife edged, roller and flat faced followers, pressure angle. (9 + 3)

GYROSCOPIC COUPLE AND SPATIAL MECHANISMS: Gyroscopic couple and its effect on aircraft, ship, two and four wheeled automobiles; Spatial mechanisms: Introduction, serial and parallel manipulators, mobility, topological arrangements, DH parameters.

(9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. John J Uicker Jr., Gordon R Pennock, Joseph E Shigley . Theory of Machines and Mechanisms ,5th Edition , New Delhi: Oxford University Press, 2016.
2. Rattan S S . Theory of Machines ,4th Edition , New Delhi: Tata McGraw -Hill Publishers, 2017.

REFERENCES:

1. Robert L Norton . Kinematics and Dynamics of Machinery (SI Units) ,1st Edition , New Delhi: McGraw Hill Higher Education, 2008.
2. David H Myszka . Machines and Mechanism ,4th Edition , Pearson Hall PTR, 2011.
3. Kenneth J. Waldron, Gary L. Kinzel, Sunil K. Agrawal . Kinematics, Dynamics, and Design of Machinery ,3rd Edition , Wiley, 2016.
4. Ashok G Ambekar . Mechanisms and Machines Theory ,1st Edition , New Delhi: PHI learning Pvt. Ltd, 2009.

19IM 305 ENGINEERING THERMODYNAMICS

3 1 0 4

FIRST LAW OF THERMODYNAMICS: Introduction, system, properties, zeroth law of thermodynamics and application, thermodynamic state and equilibrium, process and cycle, work, heat and other forms of energy; First law of thermodynamics, applications to open and closed systems, general energy equation and applications. (9 + 3)

PROPERTIES OF PURE SUBSTANCES: Ideal gas properties, equations of state, properties of mixtures, compressibility, pure substances, P-V-T Surfaces, phase change processes, vapor pressure, properties of steam, use of property tables, T-S diagrams, Mollier chart, Rankine cycle.

(9 + 3)

SECOND LAW OF THERMODYNAMICS: Kelvin-Planck and Clausius statements, heat engines and heat pump, reversibility, Carnot cycle, Carnot theorem, thermodynamic temperature scale; Third law of thermodynamics, types of Irreversibility; first and second law efficiencies.

(9 + 3)

ENTROPY: Clausius theorem, property of entropy, Clausius inequality, entropy and its applications, microscopic interpretation of entropy, maximum work obtainable from finite heat reservoirs, entropy generation in open and closed systems, isentropic work in a steady flow open system.

(9 + 3)

AVAILABILITY AND IRREVERSIBILITY: Availability, available energy referred to a cycle, maximum work in a reversible process, reversible work-open and closed systems; Availability and irreversibility; Thermodynamic relations, Maxwell's equations, Joule Kelvin effect, Clausius-Clapeyron equation, conditions of thermodynamic equilibrium and stability.

(9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Sonntag R E, Borgnakke C, Van Wylen G.J . Fundamentals of Engineering Thermodynamics, John Wiley, 2017.
2. Nag P K . Engineering Thermodynamics, Tata McGraw Hill, 2017.

REFERENCES:

1. Yunus A Cengel, Boles M A . Thermodynamics: An Engineering Approach , Tata McGraw Hill, 2017.
2. Michael Moran J, Howard Shapiro N, Daisie Boettner D, Margaret Bailey D . Fundamentals of Engineering Thermodynamics, Wiley India Pvt. Ltd, 2014.
3. Onkar Singh . Engineering Thermodynamics, New Age International, 2007.
4. Holman J P . Thermodynamics, Tata McGraw Hill, 2003.

19IM 306 ECONOMICS FOR ENGINEERS

3 0 0 3

INTRODUCTION: Definition – Nature and Scope – Central Problems of an Economy – Positive and Normative Economics– Micro Economics and Macro Economics, Significance of Economics, Economic Assumptions. (9)

THEORY OF CONSUMER BEHAVIOR: Utility – Indifference Curve Analysis - Properties, Consumer's Budget Line - Demand Analysis: Demand Function and Law of Demand, Elasticity of Demand. Demand forecasting using Econometric Techniques. Supply – Factors Affecting Supply, Market Equilibrium Price, Consumer Surplus. (9)

PRODUCTION, COST AND REVENUE: Production Function, Total Product, Average Product and Marginal Product, Returns to Scale. Costs, Nature of Costs, Short-run and Long-run Cost Curves, Revenue concepts. (9)

MARKET STRUCTURE: Types of Markets - Perfect Competition – Characteristics – Imperfect Competition: Monopoly – Monopolistic Competition – Oligopoly and Duopoly - Price Discrimination and Product Differentiation under Different Markets – Price and Output Determination in Short run and Long run and profit maximization. (9)

PERFORMANCE OF AN ECONOMY (MACRO ECONOMICS): Demand and Supply of Money – Quantity Theory of Money, Banking – Functions of Commercial Banks and Central Bank – Inflation – Causes – Control Measures – National Income – Concepts – Methods of Calculating National Income – Problems in Calculating National Income. (9)

Total L: 45

TEXT BOOKS:

1. Varian H.R. . Intermediate Microeconomics, East– West Press, 2014.
2. Dewett.K.K, Navalur. M.H. . Modern Economic Theory, S. Chand, 2015.

REFERENCES:

1. William A, McEachern, Simrit Kaur . Micro ECON , Cengage Learning, 2013.
2. William A, McEachern, Indira A. . Macro ECON , Cengage Learning, 2014.
3. Deepashree . Principles of Economics , Ane Books Pvt Ltd, 2010.
4. Dwivedi . Essentials of Business Economics , Vikas Publishing House Pvt Ltd, 2010.

19IM 310 MANUFACTURING PROCESSES LABORATORY

0 0 2 1

LIST OF EXERCISES :

1) Study of various machine tools: Specification, working principle, constructional details, operations, cutting tools, work and tool holding devices
2)) Drilling holes on a component using radial drilling machine and cutting force measurement using drill tool dynamometer
3) Machining a cast iron cube using shaping machine
4) Machining a keyway using slotting machine
5) Milling a die-pocket using vertical milling machine
6) Machining spur and helical gears using gear hobbing machine
7) Grinding a rectangular mild steel block using surface grinder
8) Grinding a cylindrical rod using cylindrical grinder
9) Making a single point cutting tool using tool and cutter grinder
10) Machining a profile using electrical discharge machine (EDM)
11) Study of additive manufacturing processes

(30)

CASE STUDY:

1. Manufacture of a model or prototype of a prismatic component used in industrial applications

(0)

Total P: 30

REFERENCES:

1. Department of Mechanical Engineering . Manufacturing Processes Laboratory Manual , PSG College of Technology, 2019.
2. Chapman WAJ . Workshop Technology - Part II ,4th Edition , New Delhi: CBS Publications, 2007.

19IM 311 MATERIALS SCIENCE AND MECHANICS OF MATERIALS LABORATORY

0 0 2 1

MATERIALS SCIENCE LABORATORY:

1) Study of metallurgical microscope and specimen preparation
2) Micro-structural study of white cast iron, grey cast iron, SG iron and malleable cast iron
3) Micro-structural study of low, medium and high carbon steels
4) Micro-structural study of normalized, hardened, hardened and tempered and case carburized steels
5) Micro structural study of Al and Cu alloys

(15)

MECHANICS OF MATERIALS LABORATORY:

1) Tension test on metals: Stress-strain characteristics
2) Hardness test on metals: Brinell, Vicker and Rockwell hardness tests
3) Impact test on metals: Charpy impact test
4) Torsion test on shafts: Torque and angle of twist characteristics
5)) Tests on helical springs: Compression, tension springs-load deformation characteristics, stiffness, torsional shear stress, modulus of rigidity, strain energy

(15)

Total P: 30

REFERENCES:

1. Department of Metallurgical Engineering . Materials Science Laboratory Manual , PSG College of Technology, 2019.
2. Department of Mechanical Engineering . Mechanics of Materials Laboratory Manual , PSG College of Technology, 2019.

SEMESTER - 4

19IM 401 PROBABILITY AND STATISTICS

2 1 0 3

DISCRETE RANDOM VARIABLES : Discrete random variables, probability distributions and probability mass functions, cumulative distribution functions, mean and variance, binomial, Poisson and geometric distributions. (6 + 3)

CONTINUOUS RANDOM VARIABLES : Continuous random variables, probability distributions and probability density functions, cumulative distribution functions, mean and variance, uniform, exponential, and normal distributions. (6 + 3)

JOINT PROBABILITY DISTRIBUTIONS : Two dimensional discrete and continuous random variables, marginal and conditional probability distributions, independence, covariance, correlation and linear regression. (6 + 3)

STATISTICAL INFERENCE : Point estimation - interval estimation – testing of hypotheses for means – large, small samples and matched pairs tests – testing of hypotheses for proportions, chi square test for goodness of fit and independence of attributes. (6 + 3)

VARIANCE TESTS AND ANALYSIS OF VARIANCE : Testing of Hypotheses for variances - analysis of variance - completely randomized design, randomized block design. (6 + 3)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Douglas C. Montgomery and George C. Runger . Applied Statistics and Probability for Engineers , Delhi: Wiley India, 2018.
2. Richard A. Johnson . Miller & Freund's, Probability and Statistics for Engineers , New Delhi: Prentice Hall, 2017.

REFERENCES:

1. Jay L. Devore . Probability and Statistics for Engineering and the Sciences , USA: Brooks/Cole, 2015.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye . Probability & Statistics for Engineers & Scientists , New Delhi: Pearson Education, 2016.
3. Robert V. Hogg, Elliot Tanis, Dale Zimmerman . Probability and Statistical Inference , USA: Pearson Education, 2014.
4. Sheldon M Ross . Introduction to Probability and Statistics for Engineers and Scientists , USA: Academic press, 2014.

19IM 402 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

3 0 0 3

ELECTRIC CIRCUITS : Ohm's law, Kirchhoff's Laws, solving simple DC Circuits-single phase AC circuit fundamentals-Power, Power factor-solving simple AC circuits- Introduction to three-phase AC circuits (8)

ELECTRICAL MACHINES : DC MOTORS: Principle of Operation-types-torque equation - speed-torque characteristics-losses and efficiency- speed control of DC motors-Electric Braking AC MACHINES: Single phase Transformers - Construction and working principle, 3 phase Induction Motor-construction–Principle of operation- types-torque equation-speed -torque characteristics-1 phase Induction Motor-Principle of operation-types – Industrial Applications (12)

ELECTRONIC DEVICES: Operation of PN junction diodes, VI characteristics, zener diode, BJT, types-CB, CE, CC configurations, input and output characteristics, JFET - working principle and characteristics - Comparison of BJT and FET. MOSFET-types, principle of operation and characteristics, Opto Electronic Devices - Introduction, types, photo conductive cells, photo diode, phototransistor, Light emitting diode-Principles and Applications (8)

ELECTRONIC CIRCUITS: (Qualitative analysis only) Half wave and full wave rectifier, capacitive filters, zener voltage regulator, RC- coupled amplifier, frequency response, RC phase shift oscillator. LINEAR INTEGRATED CIRCUITS: Operational amplifiers, Ideal op-amp characteristics, Inverting and Non-inverting amplifier, op-amp applications - Adder- Subtractor, integrator, differentiator, comparator, zero crossing detector (10)

DIGITAL ELECTRONICS: Number systems-representation of signed numbers: 1's complement and 2's complement, logic gates, Half adder, full adder, Flip flops, RS, JK, JK Master slave, D and T type, counters and shift registers (7)

Total L: 45

TEXT BOOKS:

1. Mehta V.K., Rohit Mehta . Principles of Electrical Engineering and Electronics , S.Chand & Co. Limited., 2006.
2. Salivahanan.S, Muraleedharan.K.A, Muthusubramanian R. . Basic Electrical, Electronics and Computer Engineering, Tata McGraw Hill Publishers, 2006.

REFERENCES:

1. Pillai S.K. A First Course on Electrical Drives, New Age International Publications Limited, 2011.
2. Murugesh Kumar K. . Basic Electrical Science and Technology, Vikas Publishing Limited, 2011.
3. Roy Choudhury, Shail Jain . Linear Integrated Circuits, New Age International Limited, 2003.
4. Malvino.A.P, Goutam Saha, Leach D.P. . Digital Principles and Applications, Tata Mc Graw – Hill, 2008.

19IM 403 FLUID MECHANICS

3 1 0 4

FLUID STATICS AND KINEMATICS : Properties of fluids, concept of gauge and absolute pressure, measurement of pressure using manometers; Types of flow - laminar, turbulent, steady, unsteady, uniform and non-uniform flows; Flow visualization : Stream, streak and path lines; Lagrangian and Eulerian descriptions of fluid motion. (9 + 3)

DIFFERENTIAL ANALYSIS OF FLUID FLOW : Irrotational and rotational flows, vorticity, stream function, potential function, continuity equation - derivation and applications to one dimensional flow, differential momentum equation, impact of jets - force on fixed and moving vanes; Navier Stokes equation, Euler's equation and Bernoulli's energy equation, applications of energy equations. (10 + 3)

FLOW THROUGH PIPES : Hagen Poiseuille equation: Velocity profile, power calculation; Laminar flow between parallel plates : Couette flow; Pipes in series and parallel, Darcy-Weisbach equation, use of Moody diagram; Minor losses: Sudden expansion, contraction and losses in pipe fittings.

(10 + 3)

FLOW MEASUREMENTS : Orifice meter, mouthpiece, venturimeter, flow nozzle, pitot tubes, multi-hole probe, anemometer, rotameter, hotwire anemometer, displacement meter, vortex flow meter, selection of flow meters. (8 + 3)

DIMENSIONAL ANALYSIS AND BOUNDARY LAYER THEORY : Buckingham Pi theorem, Reynolds, Froude and Mach numbers and their applications in model testing; Boundary layer theory, development of boundary layer, Prandtl's boundary layer equations, integral momentum equation, drag on a flat plate, boundary layer separation and its control, streamlined and bluff bodies, flow around circular bodies and airfoil, calculation of lift and drag.

(8 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Munson B R, Young D F, Okiishi T H and Huebsch W W . Fundamentals of Fluid Mechanics , John Wiley & Sons, 2013.
2. Yunus A Cengel and John M Cimbala . Fluid Mechanics , Tata McGraw Hill Education Pvt. Ltd, 2014.

REFERENCES:

1. Kumar D S . Fluid Mechanics and Fluid Power Engineering , Kataria S K and Sons, 2016.
2. Frank M White . Fluid mechanics , Tata McGraw Hill Education Pvt. Ltd, 2016.
3. Victor Streeter E, Benjamin Wylie K, Bedford W . Fluid Mechanics , Tata McGraw Hill, 2010.
4. Subramanya K . Fluid Mechanics and Hydraulic Machines , Tata McGraw Hill, 2018.

19IM 404 DYNAMICS OF MACHINERY

3 1 0 4

STATIC FORCE ANALYSIS OF MECHANISM : Free body diagram: Conditions of equilibrium, two, three and four force members, effect of friction in rolling and sliding pairs.

(9 + 3)

DYNAMIC FORCE ANALYSIS OF MECHANISM : Inertia force and D' Alembert's principle; Dynamic force analysis of mechanisms; Turning moment diagram: Fluctuation of energy and speed, mass of flywheel required for IC engines and mechanical presses.

(9 + 3)

BALANCING : Balancing of rotating masses: Masses in single plane and several planes; Balancing of reciprocating masses: Primary and secondary forces and couples, balancing of multi-cylinder inline engines, V and radial engines, direct and reverse crank technique; Balancing machines: Field balancing. (9 + 3)

FREE VIBRATION : Basic features of vibratory systems: Elements, single degree of freedom system; Undamped free vibration: Equation of motion, natural frequency; Damped free vibration: Damping ratio, logarithmic decrement; Transverse vibration: Dunkerley's method; Critical speed of shaft. (9 + 3)

FREE TORSIONAL VIBRATION AND FORCED VIBRATION : Torsional vibration: Two and three rotor systems, geared systems; Response to periodic force: Forcing by unbalance, support motion, force and amplitude transmissibility, vibration isolation; Vibration measurement and analysis: General considerations, vibration measurement, vibration pickups, signature analysis, preparation of Campbell diagram for rotating equipment, ISO severity code.

(9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Shigley J E , Uicker J J . Theory of Machines and Mechanisms ,5th Edition, Oxford University Press, 2016.
2. Rattan S S . Theory of Machines, Fourth Edition , McGraw Hill Education, 2017.

REFERENCES:

1. Singiresu S. Rao . Mechanical Vibrations ,6th Edition , Pearson India, 2016.
2. Ghosh , Mallick . Theory of Mechanisms and Machines ,3rd Edition , Affiliated East-West Pvt. Ltd., 2008.
3. Graham Kelly.S . Fundamentals of Mechanical Vibrations ,2nd Edition , McGraw-Hill Corporation, 2000.
4. V P Singh . Theory of Machines ,6th Edition , Dhanpat Rai & Co. (P) Limited, 2017.

19IM 405 HYDRAULICS AND PNEUMATICS

2 2 0 3

INTRODUCTION: Introduction to fluid power, properties - hydraulic fluids, air. Selection of hydraulic fluids, comparison between hydraulics and pneumatics.

(5)

ACTUATORS AND CONTROL VALVES: Actuators-types & constructional details, Pressure, flow and direction control valves – types & constructional details, seals

(7)

HYDRAULIC SYSTEM DESIGN: Sizing of hydraulic system- power pack, conduits, actuators, valves, accumulators. Heat generation and estimation of losses.

(6)

TYPICAL INDUSTRIAL APPLICATION OF HYDRAULIC SYSTEMS: deceleration circuit, regenerative circuits, feed circuits, sequencing circuits, synchronizing circuits, fail-safe circuits.

(4)

PNEUMATIC SYSTEM DESIGN: Design of sequential multi actuator circuits Cascade method, Step counter method and Karnaugh Veitch Map method. Integration of start selection, start restriction, emergency stop modules with multi actuator systems.

(10)

TYPICAL INDUSTRIAL APPLICATIONS OF PNEUMATIC SYSTEMS: Metal working, handling, clamping, counter and timer circuits.

(4)

PROGRAMMABLE LOGIC CONTROLLERS: Construction, typical specification, programming methods and applications. (4)

ADVANCED TOPICS IN FLUID POWER ENGINEERING: Servo & Proportional valves- types and applications, Hydropneumatics. (5)

Total : L: 45

TEXT BOOKS:

1. Anthony Esposito, " Fluid Power with Application", Pearson Education (Singapore) Pte.Ltd, Delhi, India, 2003.
2. Srinivasan R, "Hydraulic and Pneumatic Controls", McGraw –Hill education(India) Pvt Ltd, 2010

REFERENCES:

1. Majumdar, S.R., "Oil Hydraulic Systems: Principles and Maintenance", Tata McGraw- Hill., New Delhi, 2003.
2. Werner Deppert and Kurt Stoll, "Pneumatic Controls : An Introduction to Principles", Vogel-Druck Wurzburg, Germany, 1975.
3. Peter Rohner, "Fluid Power Logic Circuit Design – Analysis, Design Method and Worked Examples", The Macmillan Press Ltd., UK, 1979.
4.

19IM 406 INDUSTRIAL METALLURGY

3 0 0 3

CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS : Introduction to unit cells and crystal systems, imperfections in crystal systems; Solid solutions: Types and conditions; Gibbs phase rule, binary phase diagrams: Isomorphous and eutectic systems; Iron – Iron carbide equilibrium diagram. (9)

HEAT TREATMENT AND STRENGTHENING METHODS : Annealing: Full annealing, stress relief annealing, recrystallization annealing, spheroidizing; Normalizing, hardening and tempering of steel; Concept of TTT and CCT diagrams, hardenability - Jominy end quench test, austempering and martempering; Surface hardening techniques: Carburizing, nitriding, cyaniding, carbonitriding, flame and induction hardening; Strengthening of metals and alloys: Cold working/strain hardening, solid solution strengthening, dispersion hardening, precipitation hardening and grain size strengthening. (9)

MECHANICAL PROPERTIES AND TESTING : Mechanism of plastic deformation, deformation by slip, critical resolved shear stress, deformation by twinning; Types of fracture; Tensile testing: Stress-strain curve; Hardness tests (Brinell, Vickers and Rockwell); Impact test :Izod and Charpy, fracture toughness tests; Fatigue: Types, mechanism, S-N curves; Creep: Mechanisms, stages, creep curve; Fatigue and creep tests; ASTM standards for different mechanical tests; Introduction to NDT techniques: LPT, MPT, UT and RT.

(9)

FERROUS ALLOYS : Cast iron: Compositions, types, properties, applications, effect of alloying elements in steels; Plain carbon steels: Types, properties, applications; Stainless steel: Types, properties and applications; Tool steels: Types, heat treatment, properties, applications; HSLA, maraging steels, silicon steels, hadfield manganese steels.

(9)

NON-FERROUS ALLOYS : Copper and copper alloys: Brass, bronze; Aluminium alloys: Heat treatable and non heat treatable aluminium alloys, properties, precipitation hardening of aluminium alloys; Magnesium alloys: Types, properties, applications, grain refinement; Nickel base and titanium base alloys-types, properties and applications.

(9)

Total L: 45

TEXT BOOKS:

1. William D Callister . Material Science and Engineering , John Wiley and Sons, 2018.
2. Donald R Askeland, Pradeep P Fulay, Wendelin J Wright . The Science and Engineering of Materials , Thomson brooks, 2010.

REFERENCES:

1. Kenneth G Budinski and Michael K Budinski. Engineering Materials ,4th Edition, Prentice-Hall of India Private Limited, 2013.
2. Raghavan V . Materials Science and Engineering, Prentice Hall of India Pvt., Ltd, 2018.
3. Sydney H Avner. Introduction to Physical Metallurgy, McGraw-Hill Book Company, 2015.
4. Dieter G E . Mechanical Metallurgy, McGraw-Hill Book Company, 2018.

19IM 410 MACHINE DRAWING

0 0 4 2

INTRODUCTION AND CONVENTIONS : Introduction to machine drawing, sectional views of machining components; Code of practice for engineering drawing; Conventional representation of futures: Drilled and tapped holes, countersunk and counter bored holes, internal and external threads, undercuts, grooves, chamfers, fillet radii and keyways; Conventional representation of standard parts: Bolts, nuts, washers, screws, cotters, pins, circlips, bearings, gears, springs and flanges.

ASSEMBLY CONCEPTS : Assembly requirements, bill of material; Methods of assembly-bolts, nuts, studs, screws and pins; Methods of arresting motion of a member in an assembly; Assembly and dismantling exercise of a typical assembly with emphasis on assembly sequence and appropriate fits.

FITS AND TOLERANCES : Limits, fits and tolerances; Need, types, representation of tolerances on drawing, calculation of minimum and maximum clearances and allowances; Geometric tolerance: uses, types of form and position tolerances, symbols, method of indicating geometric tolerances on part drawings; Surface finish symbols
- methods of indicating the surface roughness; Blue print reading exercises; Preparation of production drawing.

ASSEMBLY DRAWING PRACTICE : Drawing practice of typical subassemblies: Sleeve and cotter joint, flange coupling, plummer block, stuffing box, gear box, foot step bearing, screw jack.

ASSEMBLY USING SOLID MODELING : Modeling and assembly using a modelling software-extracting views and sections; Drawing of assemblies: Machine vice, stop valve, drill jig, tail stock; Creation of bill of materials, calculation of mass and section properties, interference check between solids

REFERENCES:

1. BIS . SP:46-2003 – Engineering Drawing Practice for Schools and Colleges , New Delhi: , 2003.
2. John K C . Text book of Machine Drawing , New Delhi: PHI Learning Pvt. Ltd, 2009.
3. ASME Y 14.5M-2009 . Dimensioning and Tolerancing-Engineering Drawing and Related Documentation Practices , New York: ASME, 2009.
4. K. L. Narayana, P. Kannaiah, K. Venkata Reddy . Machine Drawing ,Third Edition , New Age International Publishers, New Delhi, 2006.

19IM 411 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

0 0 2 1

LIST OF EXPERIMENTS :

1) Verification of Ohm's and Kirchhoff's Laws
2) Measurement of Power and Power Factor in Single Phase RLC Circuit
3) Mechanical Characteristics of DC Shunt and Compound Motor
4) Load Test on 3 Phase Induction Motor
5) Electric Braking of 3 Phase Induction Motor (Dynamic Braking / Plugging)
6) Study of Half Wave and Full Wave Rectifiers with and without Filters
7) RC Coupled Amplifier
8) Application of Operational Amplifier : Adder, Subtractor, Integrator, and Differentiator
9) Study of Logic Gates and Implementation of Binary Adder / Subtractor
10) Implementation of Modulo – 16 Counter

(30)

Total P: 30

REFERENCES:

1. Department of EEE . Manual Prepared by EEE Department , Coimbatore: PSG College of Technology.

SEMESTER - 5

19IM 501 DESIGN OF MACHINE ELEMENTS

3 1 0 4

STATIC AND VARIABLE LOADING : Machine design: Definition, design process, machine element design, standards and codes in design, types of stress including buckling stress, contact stress and impact stress; Design for static loading: Modes of failure, factor of safety, eccentric loading, theories of failure, problems; Design for variable loading: Stress concentration, fatigue failure, endurance limit, design equations - Soderberg, Goodman and Gerber equations, combined stresses; Overview of fracture mechanics. (10 + 3)

SHAFTS, KEYS AND COUPLINGS: Design of shafts:Forces on shafts due to gears, belts and chains, design for strength and rigidity – lateral stiffness, torsional rigidity, critical speed; Design of keys; Overview of couplings and coupling design. (8 + 3)

SPRINGS: Helical springs: Stresses and deflection in round wire helical springs accounting for variable loading, concentric springs; Design of leaf springs- stress and deflection equation, nipping; Overview of the design of helical and leaf springs in automobile suspension system. (9 + 3)

RIVETED, BOLTED AND WELDED JOINTS: Riveted joints: Modes of failure, strength and efficiency, design of riveted joints – axial loading and eccentric loading, Lozenge joints; Bolted joints: Design of eccentrically loaded bolted joints; Overview of elastic analysis; Welded joints: Types, design of welded joints for different types of loading, unsymmetrical sections. (9 + 3)

BEARINGS: Rolling contact bearings: Types, method of assembly, load ratings, bearing failure, preloading, selection of deep groove ball bearings and roller bearings; Bearing mounting for machine tool spindles and axles of automobiles; Overview of hybrid bearings;Sliding contact bearings:Theory of lubrication, hydrodynamic bearings, Sommerfeld number, design of hydrodynamic bearings. (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Richard G Budynas, J Keith Nisbett. Shigley's Mechanical Engineering Design ,10th Edition , McGraw Hill Publishers Co. Ltd, 2017.
2. Bandari V.B. Design of Machine Elements ,4th Edition, Tata McGraw Hill Publishers Co. Ltd, 2017.

REFERENCES:

1. Robert L Norton. Machine Design - An integrated approach ,1st Edition, Pearson publishers, 2013.
2. Jacobson B O, Bernard J Hamrock, Steven R Schmid. Fundamentals of Machine Elements ,2nd Edition, McGraw Hill, 2004.
3. G. K. Vijayaraghavan . Design of Machine Elements ,6th Edition, Laxmi Publications, 2015.
4. Faculty of Mechanical Engineering, PSG College of Technology. PSG Design Data Book, Kalaikathir Achagam, 2012.

19IM 502 THERMAL ENGINEERING I

3 1 0 4

THERMODYNAMIC CYCLES: Determination of state's properties, terminologies and cycle efficiencies: Carnot cycle, Air standard cycles- Otto cycle, Diesel cycle, Dual cycle, comparison of Otto, diesel, and Dual Cycle. (3+3)

I C ENGINES: Classification. Principle and working of four stroke and two stroke petrol and diesel engines with P-V and T-S and valve and port timing diagrams. Comparison of petrol and diesel engines - two stroke and four stroke engines, Wankel engine- rotor and stator geometry, advantages and limitations. (4+4)

FUEL SUPPLY AND IGNITION SYSTEM: Working principles of carburetors, MPFI system. Battery and Magneto ignition type systems. Diesel fuel pumps and injector-working principle- CRDI system. Supercharging and turbo charging (3+3)

ENGINE LUBRICATION AND COOLING: necessity of lubricating system**,** properties of lubricating oil; Methods and types of lubrication systems; wet sump and dry sump systems; necessity of engine cooling; disadvantages of over cooling. Cooling systems; air cooling, water cooling: radiators. (4+4)

TESTING AND PERFORMANCE: Testing of IC engines-basics, engine measurements; air & fuel flow rate, constant speed and variable speed test, methods of estimating indicated power: Indicator diagram; Willan's line; Morse test, brake power, volumetric efficiency. Heat balance test. emission measurement, emission reduction techniques. (4+4)

FUELS & COMBUSTION ENGINEERING: Chemical reactions, fuel properties, flue gas analysis, Heating values –HCF and LCF analysis. Minimum air flow requirement for combustion. Normal and abnormal combustion processes –knocking / detonation, Factors affecting knocking/detonation in SI and CI engines; Fuel ratings: Octane and Cetane numbers, adiabatic flame temperature calculation. (6+6)

RECIPROCATING COMPRESSOR: Working principle-effect of clearance on volumetric efficiency, equations for shaft work and efficiencies, Multi-Stage Compression, inter-cooler, optimum intermediate pressure in a two stage compressor. (3+3)

ROTARY COMPRESSORS: Rotary positive displacement compressor- types-Roots Blower, Sliding Vane Compressor, Screw Compressor. Performance calculations. (3+3)

Total: L: 30 + T: 30 = 60

TEXT BOOKS:

1. Ganesan.V, "Internal Combustion Engine", Tata McGraw Hill Publishers Co. Limited, New Delhi, 1995.
2. Rudramoorthy R, "Thermal Engineering", Tata McGraw Hill Publishers Co. Ltd., New Delhi, 2003.

REFERENCES:

1. Colin R Ferguson, "Internal Combustion Engines", John Wiley and Sons, New York, 1989.
2. Kothandaraman.C.P and Domkundwar.S, "Thermodynamics and Thermal Engineering", Dhanpat Rai and Sons, New Delhi, 2004.
3. Edward F Obert, "Internal Combustion Engines", Interscience Publishers, 1971.
4. Rajput.R.K, "Thermal Engineering", Laxmi Publications (P) Limited, New Delhi, 2009.

19IM 503 OPERATIONS RESEARCH

3 1 0 4

CONCEPTS OF OPERATIONS RESEARCH AND LINEAR PROGRAMMING TECHNIQUES : Operations research and decision making, types of mathematical models and their construction; Formulation of linear programming problem, applications and limitations: Graphical method, Simplex method, Big–M method, Two–phase method; Dual problems.

(10 + 3)

TRANSPORTATION PROBLEMS : Least cost method, North West corner rule, Vogel's approximation method, Modified distribution method optimization models, degeneracy in transportation model, unbalanced and maximization models. (8 + 3)

ASSIGNMENT MODELS, SCHEDULING AND INVENTORY CONTROL : Assignment models: Hungarian algorithm, unbalanced assignment problems, maximization case in assignment problems, traveling salesman problem; Sequencing and scheduling problems: m×2, m×3, m×n and 2×n problems; Inventory control: Variables in inventory problems, inventory models with penalty, shortage and quantity discount, safety stock, inventory models with probability, lead time, demand, multi item deterministic model. (9 + 3)

PROJECT MANAGEMENT BY CPM AND PERT : Constructing project network, network computations in CPM and PERT, cost crashing, resource leveling. (8 + 3)

GAME THEORY, QUEUING MODELS AND REPLACEMENT MODELS : Game theory: Theory of games, competitive games, rules for game theory, mixed strategies, two person zero sum game, n person zero sum game, graphical method, and linear programming in game theory; Queuing models:The M/M/1 queue, The M/M/m queue, batch arrival queuing system, queues with breakdowns; Replacement models:Replacement of Items due to deterioration with and without time value of Money, Group replacement policy. (10 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Premkumar Gupta and Hira.DS. Operations Research ,7th Edition, New Delhi: S Chand and Company Limited, 2014.
2. Sundaresan V, Ganapathy Subramanian K S and Ganesan K. Operations Research (Resource Management Techniques) ,6th Edition, A R Publications, 2007.

REFERENCES:

1. Dharani Venkatakrishnan.S . Operations Research ,5th Edition, Coimbatore: Keerthi Publication House, 1996.
2. G Srinivasan. Operations Research: Principles and Application ,3rd Edition, New Delhi: PHI Learning Pvt. Ltd, 2017.
3. Kanthi Swarup, Gupta P K, Manmohan. Operations Research, New Delhi: Sultan Chand and Sons, 2014.
4. Frederick S, Hillier and Gerald J. Lieberman. Introduction to Operations Research ,10th Edition, McGraw-Hill, 2016.

19IM 504 TOOL DESIGN

3 0 0 3

CUTTING TOOLS: Materials-properties, classification, selection, insert and coated tools, tool wear, tool life. Recent developments in cutting tool technology. (4+4)

SINGLE POINT TOOLS: Nomenclature, types and styles, design and manufacture of HSS and carbide insert type tools for turning, boring, shaping, planning and slotting operations. Design of form tools.Tools and holders for CNC applications. (4+4)

MULTIPOINT CUTTERS: Nomenclature, classification and selection, construction methods, cutter setting, design and manufacture of drills, reamers, milling cutters, broaches, hobs and gear shaper cutters. Grinding-wheel specification and selection. (5+5)

JIGS: Degrees of freedom, principles of location and clamping, principles of jig design, fool proofing, elements of jigs, classification of jigs, design of jigs for drilling and reaming. (4+4)

FIXTURES: Principles of fixture design, locators and different types of clamps, elements of fixtures, provision for cutter setting, design of fixtures for milling, turning, boring and grinding operations. Fixtures for turning centers and machining centers.Modular fixturing-concepts and applications. (4+4)

PRESS TOOLS: Design of sheet metal parts, Design and manufacture of die sets for sheet metal components-simple, compound and progressive dies for punching and blanking operations. Dies for drawing and bending operations.Selection of press tools. (4+4)

DESIGN OF INJECTION MOULDING AND DIE CASTING DIES: Product and mould, thermal considerations, design of two plate mould, runner and gate design, mould cooling and ejection. Overview of shrinkage and warpage analysis. (4+4)

LIMIT GAUGES: Design of plug, ring and snap gauges. (1+1)

Total = L: 30+ T: 30 = 60

TEXT BOOKS:

1. Arshinov.V and Alekseev.G, "Metal cutting Theory and Cutting Tool Design", MIR Publishers, Moscow, 1976.
2. Donaldson.C and LeCain.C.H, "Tool Design", Tata McGraw Hill Publishing Company Limited, New Delhi, 2004.

REFERENCES:

1. ASTME, “Fundamentals of Tool Design”, Prentice Hall, INC, New Delhi, 1962.
2. Kempster, "Introduction to Jig and Tool Design", VIVA Books, New Delhi, 1998.
3. Cracknell.P.C and Dyson.R.W, “Handbook of Thermoplastics Injection Mould Design”, Chapman and Hall, 1993.
4. Paquin.J.R and CrowleyJ R Paquin, “Die Design Fundamentals”, Industrial Press, NY, 2006.

19IM 505 MANUFACTURING AUTOMATION

3 0 0 3

PNEUMATICS: Symbols, compressors, types of actuators, pressure, flow and direction control valves, time delay valves and counters, design of sequential circuits using intuitive and cascade methods. (9)

COMPUTER NUMERICAL CONTROL MACHINES: Numerical control: Basic theory, advantages of numerical control, open and closed loop systems, classification of CNC machine tools; Salient design features of CNC machines; Drive system for CNC machine tools; Manual and computer aided part programming: G and M functions, canned cycles for turning and machining centers. (9)

INDUSTRIAL ROBOTICS: Anatomy of a robot and robot end effectors, classification of robots based on physical configuration, transducers; Sensors: Tactile sensors, proximity and range sensors, velocity sensors and vision systems; Robot programming methods; Concepts of forward and inverse kinematics. (9)

REAL TIME INTERFACING: Data acquisition systems, virtual instrumentation, interfacing of sensors/actuators with PC, condition monitoring, adaptive control, HMI and SCADA systems. (9)

INDUSTRIAL IOT: IoT architecture, M2M Architecture; Cloud: Types, edge analytics, fog computing; Augmented reality and virtual reality, big data analytics, predictive analytics. (9)

Total L: 45

TEXT BOOKS:

1. Mikell P Groover. Automation, Production Systems and Computer-Integrated Manufacturing, Pearson Education, 2016.
2. Devdas Shetty and Richard A Kolk. Mechatronics System Design, PWS Publishing Company, 2010.

REFERENCES:

1. Mikell P Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey . Industrial Robotics, Tata McGraw-Hill, 2008.
2. Anthony Esposito. Fluid Power with Applications ,7th Edition, India: Pearson Education, 2013.
3. Alasdair Gilchrist. Industry 4.0: The Industrial Internet of Things ,1st Edition, Apress, 2017.
4. Sanjay Gupta and Joseph John. Virtual instrumentation using Lab VIEW, Tata McGraw-Hill Publications Co. Ltd, 2017.

19IM 510 FLUID MACHINERY LABORATORY

0 0 2 1

LIST OF EXPERIMENTS :

1. Flow measurement using mouthpiece and orifice.
2. Calibration and comparison of instruments for measuring flow through pipes- orifice, venturi

meter, water meter and rotameter.
3. Calibration and comparison of open channel flow measuring instruments- V-Notch and Rectangular Notch
4. Measurement of force on vane due to impact of jet
5. Determination of lift and drag coefficients using wind tunnel
6. Performance test on axial flow fan
7. Performance test on centrifugal blower
8. Performance test on reciprocating pump
9. Performance test on centrifugal pump
10 Performance test on impulse water turbine
11 Performance test on reaction water turbine

(30)

Total P: 30

REFERENCES:

1. Department of Mechanical Engineering. Fluid Machinery Laboratory Manual, PSG College of Technology, 2019.
2. Kumar D S . Fluid Mechanics and Fluid Power Engineering, Kataria S K and Sons, 2016.

19IM 511 THERMAL ENGINEERING LABORATORY

0 0 2 1

LIST OF EXPERIMENTS :

1) Valve timing diagram of a 4-stroke diesel engine
2) Port timing diagram of a 2-stroke petrol engine
3) Performance test on constant speed 4-stroke diesel engine.
4) Variable speed test on multi-cylinder diesel engine
5) Heat balance test on 4-stroke diesel engine
6) Performance testing of petrol engine
7) Performance test on two stage reciprocating air compressor
8) IC engine performance evaluation using PC interface module
9) Testing of HVAC (heating, ventilation and air conditioning) system
10) Performance analysis of refrigeration system
11) Study on diesel fired steam power plant

(30)

Total P: 30

REFERENCES:

1. Department of Mechanical Engineering . Thermal Engineering Laboratory Manual , PSG College of Technology, 2019.
2. Ganesan V . Internal Combustion Engines , Tata McGraw Hill, 2013.

19IM 512 MANUFACTURING AUTOMATION LABORATORY

0 0 2 1

LIST OF EXPERIMENTS:

1) Co-ordinated motion of multiple pneumatic actuators in a desired sequence using intuitive method
2) Co-ordinated motion of multiple pneumatic actuators in a desired sequence using cascade method
3) Co-ordinated motion of multiple actuators, electro–pneumatic systems in a desired sequence using hard wire and PLC control systems
4) Programming of CNC turning center
5) Programming of CNC machining center
6) Programming of an obstacle avoidance robot using servo motors, ultrasonic and touch sensors
7) Programming of a path following mobile robot
8) Interfacing of LVDT with a PC for monitoring the displacement of machine slide
9) Interfacing of thermocouple to monitor and maintain chamber temperature
10) Interfacing of hot wire anemometer with data acquisition system to measure air flow rate
11) IoT based temperature and position measurements.

(30)

CASE STUDY:

1) Development of an automation system integrating sensors, actuators and control unit.

(0)

Total P: 30

REFERENCES:

1. Department of Mechanical Engineering . Manufacturing Automation Laboratory Manual , PSG College of Technology, 2019.
2. J Jerome . Virtual Instrumentation Using Labview , New Delhi: Prentice Hall, 2010.
3. Mahesh Dhotre, D Rao . CNC Machine Tool Technology with Programming and Operating , Pune: Sai Prakashan, 2018.
4. Agus Kurniawan . SimpleLink Wi-Fi CC3200 LaunchPad Primer ,2nd Edition , USA: PE Press, 2018.

SEMESTER - 6

19IM 601 DESIGN OF TRANSMISSION ELEMENTS

3 0 0 3

SPUR AND HELICAL GEARS : Review of gear fundamentals, types of gears, interference and undercutting, gear force analysis; Spur gears: Failures in gears, beam strength, comparison of tooth shapes, design of spur gears including non-metallic gears; Helical gear: Virtual number of teeth, design of helical gears; Overview of bevel gear design. - (9)

WORM GEARS, SPEED REDUCERS AND GEAR BOXES : Worm gears: Materials, modes of failure and design stresses, efficiency, thermal considerations, design of worm gears; Speed reducers: Design of single stage speed reducer, gear tooth forces, shaft design and bearing selection; Overview of gear box design for automotive manual transmission and automatic transmission. (10)

BELT AND CHAIN DRIVES : Belt drives: Design using basic equations, design of flat and V- belt drives based on manufacturer's data, timing belt; Chain drives: Chordal action, drive failures, design of chain drive, silent chain. (9)

POWER SCREWS : Forms of threads, square and trapezoidal threads, collar friction, force analysis and design of power screws and screw jack; Design of differential and compound screws, recirculating ball screws. (8)

CLUTCHES AND BRAKES : Clutches: Role of clutches, positive and gradually engaged clutches, design of single plate and multiple plate clutches; Brakes: Role of brakes, types of brakes, self-energizing and de-energizing brakes, thermal considerations, design of single shoe and double shoe brakes, design of disc brakes, design of internally expanding shoe brakes; Overview of band brakes and anti-lock braking system. (9)

Total L: 45

TEXT BOOKS:

1. Bandari V.B . Design of Machine Elements ,4th Edition , New Delhi: Tata McGraw Hill Publishers Co. Ltd, 2017.
2. Robert L Norton . Machine Design - An Integrated Approach ,2nd Edition , Pearson Education, 2013.

REFERENCES:

1. Richard G Budynas, J Keith Nisbett . Shigley’s Mechanical Engineering Design ,10th Edition , McGraw Hill Publishers Co. Ltd., 2017.
2. Robert L Mott . Machine Elements in Mechanical Design ,4th Edition , Pearson/Prentice Hall, 2004.
3. V. Jayakumar . Design of Transmission Elements ,7th Edition , Laxmi Publications, 2015.
4. Faculty of Mechanical Engineering, PSG College of Technology . PSG Design Data Book , Kalaikathir Achagam, 2012.

19IM 602 HEAT AND MASS TRANSFER

3 1 0 4

STEADY STATE HEAT CONDUCTION: Concepts of heat and mass transfer, three-dimensional heat conduction equations in various co-ordinate systems, steady state one dimensional heat conduction equation, thermal analogy for complex system analysis, variable thermal conductivity, heat transfer with heat generation in different shapes. (9 + 3)

UNSTEADY STATE HEAT CONDUCTION: Lumped parameter systems, infinite solids, and semi-infinite solids, numerical and graphical methods. (9 + 3)

CONVECTION HEAT TRANSFER: Differential analysis of hydrodynamic and thermal boundary layers; Forced and free convection, external and internal flow, laminar and turbulent flow, convective mass transfer, non-dimensional analysis. (9 + 3)

RADIATION AND PHASE CHANGE HEAT TRANSFER : Emissive power, grey body, irradiation, radiosity, Radiation heat transfer between surfaces, shape factor, radiation shield, gas radiation; Boiling heat transfer: bubble growth, freezing and melting; Condensation: Film wise condensation and drop wise condensation. (9 + 3)

APPLICATIONS OF HEAT TRANSFER : Heat transfer enhancement techniques in various applications; Fins: Types of fins, effectiveness and efficiency of fins; Heat exchangers: Types, tube and shell arrangements, single and multi-pass types, parallel, counter flow, cross flow and compact heat exchangers, LMTD and effectiveness method (NTU).

(9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Theodore L. Bergman, Adrienne S Lavine, Frank P. Incropera, David P. DeWitt . Fundamentals of Heat and Mass Transfer , Wiley India Private Limited, 2017.
2. Yunus A Cengel . Heat Transfer: A Practical Approach , Tata McGraw Hill Inc., 2017.

REFERENCES:

1. John H Lienhardd, John H Lienhard . Heat Transfer Text Book , Phlogiston Press, 2017.
2. Kothandaraman C P . Fundamentals of Heat and Mass Transfer , New Age International (P) Limited, 2014.
3. Nag P K . Heat and Mass Transfer , McGraw Hill Education, 2011.
4. Ramesh K Shah, Dusan P Sekulic . Fundamentals of Heat Exchanger Design , John Wiley & Sons, 2003.

19IM 603 METROLOGY AND INSTRUMENTATION

3 0 0 3

BASICS OF MEASUREMENT SYSTEM AND DEVICES : Definition of metrology, accuracy, precision and sensitivity, Abbe's principle; Three stages of generalized measurement system, mechanical loading, factors considered in selection of instruments, commonly used terms, uncertainity, traceability, error analysis and classification, sources of error; Principle of interferometry, Michelson interferometer, NPL flatness interferometer, laser interferometer.

(8)

CALIBRATION OF INSTRUMENTS AND QUALITY STANDARDS : Calibration of measuring instruments, principles of calibration, calibration of vernier caliper, micrometer, feeler gauges, dial indicator, surface plates, slip gauges; Care of gauge blocks-general rules in measurement and preservation methods; ISO 9000 quality standards and ISO 14001 environmental management standards. (9)

COMPARATORS AND GEOMETRICAL MEASUREMENT : Comparators - mechanical, electrical, optical and pneumatic; Angular measurement: Optical protractors, sine bar; Roundness measurement, limit gauge, design of plug gauge, Taylor's principle, three basic types of limit gauges; Components of surface texture: Roughness, lay, waviness, Ra and Rz, surface roughness meter; Computer controlled CMM. (9)

MEASUREMENT OF SCREW THREAD AND SPUR GEAR TERMINOLOGY : ISO metric thread, measurement of major, minor and effective diameters; Gear terminology, spur gear measurement, checking of composite errors, base pitch measurement. (9)

INDUSTRIAL MEASUREMENTS : Position sensors: Potentiometer, LVDT; Proximity sensors-types; Vibration sensors - seismic instrument; Torque sensors; Strain gauges; Temperature sensors: Resistance temperature detector, thermistor, thermocouples, J&K type and thermopiles, optical pyrometer; Pressure sensor: Elastic transducers, pressure cell, bulk modulus pressure gauge; Low pressure measurement; Thermal conductivity gauge; Flow measurement: Turbine type meter, hotwire anemometer, magnetic flow meter.
(10)

Total L: 45

TEXT BOOKS:

1. Gupta I C . A text book of Engineering Metrology, New Delhi: Dhanpat Rai Publications, 2007.
2. Beckwith T G, Roy D, Marangoni, John H Lienhard . Mechanical Measurements , Prentice Hall, 2006.

REFERENCES:

1. Alan S Morris, Reza Langari . Measurement and Instrumentation: Theory and Application, Academic Press, 2012.
2. Venkateshan S P. Mechanical Measurements, John Wiley & Sons, 2015.
3. Holman J P. Experimental Methods for Engineers, Tata McGraw Hill Publications Co Limited, 2004.
4. Alan S Moris . ISO 14000 Environmental Management Standards, John Wiley & Sons.

19IM 604 DESIGN FOR MANUFACTURE AND ASSEMBLY

3 1 0 4

DFMA GUIDELINES AND TOLERANCE ANALYSIS : DFM approach: DFM/DFA guidelines, DFA index, comparison of materials on cost basis; Process capability metrics: Cp, Cpk. Feature tolerances, geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining processes; Cumulative effect of tolerances: sure fit law, normal law and truncated normal law. (9 + 3)

SELECTIVE ASSEMBLY : Interchangeable and selective assembly - deciding the number of groups; Model-I - group tolerances of mating parts equal; Model-II - Total and group tolerances of shaft equal; Number of shafts/holes in each group, control of axial play - introducing secondary machining operations, laminated shims. (9 + 3)

DATUM SYSTEMS : Degrees of freedom, grouped datum systems, two and three mutually perpendicular grouped datum planes, grouped datum system with spigot and recess, pin and hole, tongue and slot pairs, computation of translational and rotational accuracy, geometric analysis and applications; Datum features - functional and manufacturing; Component design - machining considerations, redesign for manufacture, examples. (9 + 3)

TRUE POSITION TOLERANCING THEORY : Comparison between co-ordinate tolerancing and true position tolerancing, virtual size concept, floating and fixed fasteners, projected tolerance zone, zero true position tolerance,functional gauges, paper layout gauging, compound assembly, composite tolerancing, examples. (9 + 3)

FORM DESIGN OF CASTINGS, WELDMENTS AND TOLERANCE CHARTING : Redesign of castings based on parting line considerations, minimising core requirements; Redesign of cast members using weldments, use of welding symbols – case studies; Operation sequence for typical shaft type of components, preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples. (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Spotts M F . Dimensioning and Tolerancing for Quantity Production ,1st Edition , New Jersey: Prentice Hall Inc, 1983.
2. ASME Y 14.5M-2009 . Dimensioning and Tolerancing - Engineering Drawing and Related Documentation Practices , New York: ASME, 2009.

REFERENCES:

1. Harry Peck . Designing for Manufacture ,1st Edition , London: Pitman Publications, 1983.
2. Oliver R Wade . Tolerance Control in Design and Manufacturing ,1st Edition , New York: Industrial Press Inc, 2008.
3. James G Bralla . Hand Book of Product Design for Manufacturing , McGraw Hill Publications, 1986.
4. Creveling .C. M . Tolerance Design - A Hand Book for Developing Optimal Specifications , USA: Addison Wesley Longman Inc, 1997.

19IM 033 INTERNET OF THINGS FOR MECHANICAL APPLICATIONS

3 0 0 3

CONCEPTS OF IOT : IoT: Characteristics, applications, enablers; Comparison between IoT, M2M, and WoT; IoT interdependence; IoT network configurations - comparison between IPv4 and IPv6; IoT components, interoperability, IoT challenges; Comparison between Industrial IoT and IoT. (8)

DATA COLLECTION : Sensing: Sensors, transducers, sensor resolution, types of sensors; Actuation: Actuator, types of actuators; Communication protocols: 802.15.4, ZigBee, 6lowpan, RFID, NFC, Bluetooth, Z-wave; Embedded systems - Arduino, Raspberry Pi.(10)

DATA PROCESSING AND DATA HANDLING : Data processing: MQTT, MQTT components and methods; Data handling: Big data, types of data, flow of data; Cloud computing: Recent trends, service models, managing data in cloud. (9)

DATA ANALYTICS AND DATA SECURITY : Data analytics: Types, lifecycle- discovery, preparation, model planning, model building; Data collection; Streaming data analytics: Hadoop, Hive, Hbase; Data security: Data protection, challenges. (9)

MECHANICAL APPLICATIONS : Manufacturing: Machine diagnostics and prognosis, robotics and autonomous vehicles and part tracing; Inventory and logistics: Route generation and scheduling, fleet tracking, shipment monitoring, remote vehicle diagnostics; Energy: Smart grids, waste management; Safety and security: Indoor air quality monitoring, noise level monitoring, smoke/gas detections, structural health monitoring.

(9)

Total L: 45

TEXT BOOKS:

1. Alasdair Gilchrist , "Industry 4.0: The Industrial Internet of Things", 1st Edition, Apress, 2016.
2. Ulrich Sendler , "The Internet of Things: Industrie 4.0 Unleashed", 1st Edition, Springer, New York, 2019.

REFERENCES:

1. Sabina Jeschke, Christian Brecher, Houbing Song, Dana B. Rawat , "Industrial Internet of Things: Cyber- manufacturing Systems", Springer, 2016.
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles , "Architecting the Internet of Things", Springer, New York, 2011.
3. Adrian McEwen, Hakim Cassimally , "Designing the Internet of Things", John Wiley and Sons Ltd, UK, 2014.
4. Thomas Er, Dr. Zaigham Mahmood, Professor Ricardo Puttini , "Cloud Computing: Concepts, Technology & Architecture", PHI, 2013.

19IM 610 METROLOGY AND DYNAMICS LABORATORY

0 0 2 1

METROLOGY LABORATORY :

1)) Gear roll testing (i) Tooth to tooth composite error (ii) Tooth thickness measurement using gear tooth vernier caliper.
2) Measurement of screw thread parameters using optical profile projector.
3) (i) Angular measurement using sine bar (ii) Internal taper measurement using two ball method.
4) Tool geometry measurement using tool makers microscope.
5) Measurement of effective diameter of external parallel screw threads using floating carriage micrometer.
6) Study of Coordinate Measuring Machine (CMM) and surface roughness measurement.

(15)

DYNAMICS LABORATORY :

1) Static and dynamic balancing using dynamic balancing machine.
2) Preparation of cam displacement curve and determination of jump speed of a cam.
3) Determination of natural frequencies of transverse, torsional vibrations and critical speed of a shaft.
4) Determination of pressure distribution in a journal bearing.

5) Determination of mass moment of inertia of connecting rod and validation using software.
6) Study of friction and wear measurement using Pin-on-Disc method.

(15)

Total P: 30

REFERENCES:

1. Department of Mechanical Engineering . Metrology Laboratory Manual , PSG College of Technology, 2019.
2. Department of Mechanical Engineering . Dynamics Laboratory Manual , PSG College of Technology, 2019.

19IM 611 HEAT TRANSFER LABORATORY

0 0 4 2

LIST OF EXPERIMENTS :

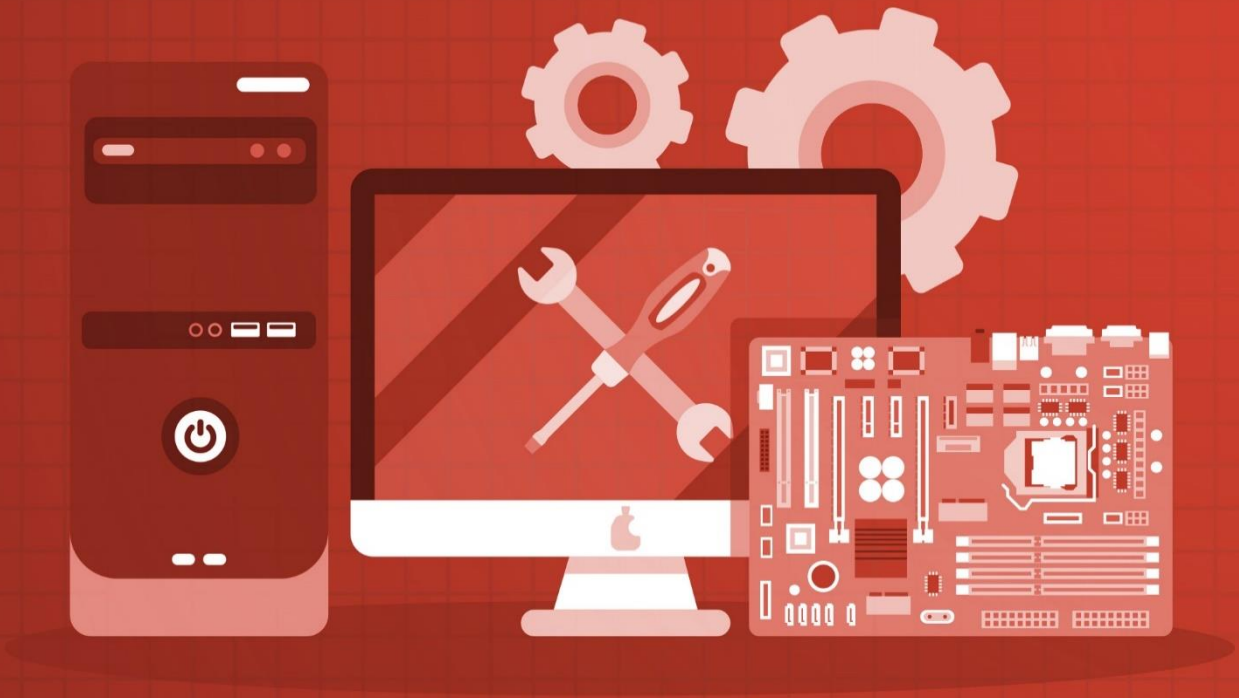
1) Determination of thermal conductivity using guarded hot plate apparatus
2) Study of unsteady state heat conduction
3) Determination of thermal conductivity of insulating powder
4) Heat Transfer analysis using pin-fin apparatus
5) Determination of natural convective heat transfer coefficient for a vertical cylinder
6) Determination of forced convective heat transfer coefficient for a hollow tube
7) Determination of Stefan-Boltzmann constant
8) Determination of emissivity of grey surface
9) Determination of effectiveness of parallel /counter flow heat exchanger
10) Determination of heat transfer coefficient in film and drop wise condensation

(60)

Total P: 60

REFERENCES:

1. Yunus A Cengel . Heat Transfer: A practical Approach , Tata McGraw Hill Inc, 2017.
2. Department of Mechanical Engineering . Heat Transfer Laboratory Manual , PSG College of Technology, 2019.



COMPUTER SCIENCE ENGINEERING

COURSES OF STUDY AND SCHEME OF ASSESSMENT

Code No.	Course Title	Periods / week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	FE	Total
SEMESTER I								
19IZ 101	Calculus and its Applications	3	1	0	4	50	50	100
19IZ 102	Electrical and Electronics Systems	3	0	0	3	50	50	100
19IZ 103	Chemistry of Electronic Materials	3	0	0	3	50	50	100
19IZ 104	Problem Solving and Python Programming	3	0	0	3	50	50	100
19IZ 105	English Language Proficiency	2	1	0	3	50	50	100
19IZ 110	Basic Science Laboratory	0	0	2	1	50	50	100
19IZ 111	Engineering Practices	0	0	4	2	50	50	100
19IZ 112	Python Programming Laboratory	0	0	4	2	50	50	100
19IG 065	German Language - A1	12	0	0	4	-	100	100
19IH 071	Indian Language	2	1	0	3	50	50	100
SEMESTER 2								
19IZ 201	Transforms and its Applications	3	1	0	4	50	50	100
19IZ 202	Materials Science	3	0	0	3	50	50	100
19IZ 203	Industrial Electrochemistry	2	0	0	2	50	50	100
19IZ 204	Digital Design	3	0	0	3	50	50	100
19IZ 205	C Programming	2	2	0	4	50	50	100
19IZ 211	Digital Design Laboratory	0	0	4	2	50	50	100
19IZ 212	C Programming Laboratory	0	0	2	1	50	50	100
19IZ 213	Engineering Graphics	0	0	4	2	50	50	100
19IZ 214	Professional Skills	0	0	9	2	50	50	100
19IZ 215	Internship – Summer Training	0	0	0	2	100	-	100
19IG 066	German Language – A2	12	0	0	4	-	100	100
19IH 072	American History	2	1	0	3	50	50	100
SEMESTER 3								
19IZ 301	Linear Algebra	3	1	0	4	50	50	100
19IZ 302	Data Structures	4	0	0	4	50	50	100
19IZ 303	Computer Architecture	3	1	0	4	50	50	100
19IZ 304	Discrete Structures	2	1	0	3	50	50	100
19IZ 305	Object Oriented Programming	3	0	0	3	50	50	100
19IZ 306	Economics for Engineers	3	0	0	3	50	50	100
19IZ 310	Data Structures Laboratory	0	0	2	1	50	50	100
19IZ 311	Object Oriented Programming Laboratory	0	0	2	1	50	50	100
19IZ 312	Environmental Science	2	0	0	0	100	-	100
19IG 067	German Language – B1.1	12	0	0	4	-	100	100
19IH 073	Organizational Behavior	3	0	3	3	50	50	100

SEMESTER 4								
19IZ 401	Probability, Stochastic Processes and Statistics	3	1	0	4	50	50	100
19IZ 402	Design and Analysis of Algorithms	3	1	0	4	50	50	100
19IZ 403	Operating Systems	3	0	0	3	50	50	100
19IZ 404	Database Management systems	3	0	0	3	50	50	100
19IZ 405	Software Engineering	3	0	0	3	50	50	100
19IZ 410	Operating Systems Laboratory	0	0	2	1	50	50	100
19IZ 411	Database Management systems Laboratory	0	0	2	1	50	50	100
19IG 068	German Language – B1.2	12	0	0	4	-	100	100
19IH 074	TOEFL / IELTS Training	6	0	9	2	50	50	100
SEMESTER 5								
19IZ 501	Theory of computing	3	1	0	4	50	50	100
19IZ 502	Microprocessors and Interfacing	3	0	0	3	50	50	100
19IZ 503	Artificial Intelligence	3	0	0	3	50	50	100
19IZ 504	Computer Networks	3	0	0	3	50	50	100
19IZ 505	Object Oriented Analysis and Design	2	2	0	4	50	50	100
19IZ 510	Computer Networks Laboratory	0	0	2	1	50	50	100
19IZ 511	Microprocessors and Interfacing Laboratory	0	0	2	1	50	50	100
19IZ 512	Software Package Development	0	0	4	2	50	50	100
19IQ 513	Business and Managerial Communications	0	0	2	1	100	0	100
19IG 069	German Language – B2	12	0	0	4	-	100	100
SEMESTER 6								
19IZ 601	Machine Learning	3	0	0	3	50	50	100
19IZ 602	Compiler Design	3	1	0	4	50	50	100
19IZ 603	Distributed Computing	3	0	0	3	50	50	100
19IZ 604	Embedded Systems	2	2	0	4	50	50	100
19IZ610	Machine Learning Laboratory	0	0	2	1	50	50	100
19IZ 611	Distributed Computing Laboratory	0	0	2	1	50	50	100
19IZ 612	Application Development Laboratory	0	0	4	2	50	50	100
19IZ 620	Innovation Practices	0	0	4	2	50	50	100
19IG 070	German Language – C1/ TESTDAF	12	0	0	4	-	100	100

DETAILED SYLLABI

SEMESTER - 1

19IZ 101 CALCULUS AND ITS APPLICATIONS

3 1 0 4

DIFFERENTIAL CALCULUS: Functions of two variables, limit, continuity, partial derivatives, differentiability, linearization and total differential, extreme values and saddle points, Taylor's formula for two variables. (9 + 3)

MULTIPLE INTEGRALS I: Double integrals over rectangles, double integrals as volumes, Fubini's theorem, double integrals over general regions, changing the order of integration, double integrals in polar form, applications to area, volume. (9 + 3)

MULTIPLE INTEGRALS II: Triple integrals in rectangular coordinates, spherical and cylindrical coordinates, applications to volume. (9 + 3)

SECOND ORDER LINEAR ORDINARY DIFFERENTIAL EQUATIONS: Homogeneous equations with constant coefficients, superposition principle, initial value problem, general solution, Euler-Cauchy equation, non-homogeneous linear equations, method of variation of parameters, modeling of electric circuits. (9 + 3)

VECTOR CALCULUS: Directional derivative and gradient vectors, vector fields, divergence, curl. Integration in vector field - line integrals, work, circulation and flux, path independence. Green's, Gauss divergence and Stokes's theorems. (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Maurice D. Weir, Joel Hass, Christopher Heil "Thomas' Calculus", Pearson Education., New Delhi, 2018
2. Erwin Kreyszig "Advanced Engineering Mathematics", Wiley India Pvt Ltd., New Delhi, 2015

REFERENCES:

1. Gilbert Strang "Calculus", Wellesley-Cambridge Press., USA, 2017
2. Marsden J E, Tromba A J, Weinstein A "Basic Multivariable Calculus", Springer Verlag., NewYork, 2019
3. James Stewart "Multivariable Calculus", Cengage Publishing., Boston, 2017
4. Howard Anton, Irl Bivens, Stephen Davis "Calculus", John Wiley and Sons, INC., USA, 2016

19IZ 102 ELECTRICAL AND ELECTRONICS SYSTEMS

3 0 0 3

DC CIRCUIT: current-voltage –power-energy, electrical circuit elements: resistors-inductor- capacitor, source of electrical energy. Ohm's law-Kirchhoff's laws, series and parallel circuits, Maxwell's loop current method, Network theorems: superposition theorem-Thevenin's theorem-Norton's theorem-maximum power transfer theorem. (9)

AC CIRCUITS: Single phase AC circuits: Average and RMS values of sinusoidal wave form-RLC Circuit-Phasor representation-active, reactive apparent power –power factor, analysis of RLC Circuit, three phase circuit: star and delta connection-phase and line quantities-balance and unbalance systems (9)

ELECTROMAGNETISM AND MAGNETIC CIRCUITS: Electromagnetic induction: induced currents, Faraday's law, induction and energy, motional emf and Lenz's law. Magnetic field-magnetic circuit-inductance and mutual inductance-magnetic materials –ideal transformers and real transformers (8)

SEMICONDUCTOR DEVICES: Basic diode concepts-diode circuit: half wave rectifier-full wave rectifier-bridge rectifier-special purpose diodes-zener diode –transistor fundamentals – transistor biasing-bipolar junction transistors-basis amplifier concept-loading effect-power supplies and efficiency (10)

OPERATIONAL AMPLIFIERS: Definition of terms – Inverting and non-inverting amplifiers, inverting summing amplifier, integrators and differentiators. (9)

Total L: 45

TEXT BOOKS:

1. John Hiley, Keith Brown, Ian McKenzie Smith, Edward Hughes "Electrical and Electronic Technology", Pearson education., New Delhi, 2016 , twelfth edition
2. Murugesh Kumar K "Basic Electrical Science and Technology", Vikas Publishing House., New Delhi, 2009

REFERENCES:

1. Leach D P "Digital Principles & Applications", Tata McGraw Hill., 2014, eighth edition
2. Hambley A R "Electrical Engineering Principles and Applications", PHI Learning Pvt. Ltd., New Delhi, 2011
3. Boylestad R. L., Nashelsky L "Electronic Devices and Circuit Theory", Pearson Education., Noida, 2014, eleventh edition
4. Theraja B. L. "Basic electronic Solid State", S. Chand & Company Ltd., New Delhi, 2010

19IZ 103 CHEMISTRY OF ELECTRONIC MATERIALS

3 0 0 3

CONDUCTING PROPERTIES OF MATERIALS: Molecular orbital treatment of bonding in metals, insulators, semiconductors – direct band and indirect band, elemental, p-doped, n-doped, stoichiometric compound semiconductors and chalcogen semiconductors. Crystal defects and their influence on properties of materials – intrinsic defects - schottky and frenkel, non-stoichiometeric compounds, extrinsic defects - oxide ion conductors - applications. Nanoscale materials – Quantum dots-band gap – size dependant optical properties. (9)

POLYMERIC MATERIALS: Classification, degree of polymerization, average molecular weights, polydispersity. Polymerization reactions – chain and condensation. Thermal properties -glass transition temperature (Tg) – factors affecting Tg - determination by DSC. Mechanical properties – significance in fabrication of electronics. Electrical insulating properties - dielectric breakdown - aging of polymer insulations - discharges in voids, electrical treeing. Thermal and photochemical degradations. Additives - plasticisers, stabilisers, functional additives. (9)

FLEXIBLE ELECTRONIC MATERIALS: Conjugated polymers – electronic energy bands - mechanism of charge transport – intrachain and interchain - solitons, polarons and bipolarons. Factors influencing charge transport – structural features - defects, molecular weight,

crystalline/amorphous nature, doping- oxidative and reductive. Synthesis, properties and applications of polyaniline, polythiophene and polypyrrole. Molecular electronics - graphene, fullerenes, carbon nanotubes – structure, synthesis, properties and applications. (9)

OPTOELECTRONIC MATERIALS: Electroluminescence- exciton, OLED materials– emitters- charge transfer complexes, metal chelates, polycyclic aromatic oligomers, conjugated polymers – polyphenylenes, polyfluorenes. Liquid crystalline polymers- classification of liquid crystals, chemical constitution, stability and applications. Organic and dye sensitized photovoltaics – working principle, materials, advantages and disadvantages. Preparation of ultrathin polymer films - Langmuir-Blodgett Films –self assembled monolayers. (9)

MATERIALS FOR ELECTRONICS PROCESSING: Semiconductor wafer fabrication -Overview and challenges –high purity chemicals, air filters for clean rooms, electronic grade water- quality parameters, water treatment stages for ultrapure water production – membranes and ion-exchange resins, electrodialysis. Photoresists for wafer fabrication – microlithography, resist requirements, material chemistry. Electronic packaging materials-adhesives, connectors, eutectic alloys, phase change materials-phase diagrams, applications. (9)

Total L: 45

TEXT BOOKS:

1. Lesley E.Smart, Elaine A.Moore "Solid State Chemistry - an Introduction", CRC Press., London, 2005. , fourth edition
2. Cowie J.M.G, Valeria Arrighi "Polymers: Chemistry and Physics of modern materials", CRC Press., London, 2007., third edition

REFERENCES:

1. Bansi D. Malhotra "Handbook of Polymers in Electronics", Rapra Technology Ltd.., UK, 2002. , first edition
2. Stergios Logothetidis "Handbook of Flexible Organic Electronics Materials - Manufacturing and Applications", WoodHead publishing., London, 2015. , first edition
3. Peter Van Zant "Microchip Fabrication: A Practical Guide to Semiconductor Processing", Mc Graw Hill,., 2014. , sixth edition
4. Shashi Chawla "A Textbook of Engineering Chemistry", Dhanpat Rai and Co.., New Delhi, 2005 , first edition.

19IZ 104 PROBLEM SOLVING AND PYTHON PROGRAMMING

3 0 0 3

INTRODUCTION TO PROBLEM SOLVING: Introduction - Problem solving and Decomposition - Abstraction - Notations - Pseudo code - Flow chart - Programming language (8)

ALGORITHMIC PROBLEM SOLVING : Algorithm Implementation - Top down design - Simple strategies for developing algorithms - Iteration - Recursion - Fundamental algorithms - Anticipating and Dealing with Errors (8)

BASICS BUILDING BLOCKS OF PYTHON : Variables - Immutable variables - Data types - Operators – Python Reserved Words - Understanding error messages (9)

CONTROL STATEMENTS AND STRUCTURED TYPES: Control Flow - Indenting - if Statement - while Loop – break and continue - for Loop - String - Lists - Tuples - Sets - Dictionaries (10)

FUNCTIONS , MODULES AND FILES : Definition - Hiding redundancy - Arguments and return values - Variable Number of Arguments - Scope - Passing Functions to a Function - Mapping Functions in a Dictionary - Lambda function - Recursive Functions - Modules: Standard Modules - OS and SYS modules - User defined Modules - Importing modules - Writing into a File - Reading from a File - File Methods (10)

Total L: 45

TEXT BOOKS:

1. R. G. Dromey "How to Solve it by Computer", Pearson Education., 2015
2. Charles Dierbach "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India., 2015

REFERENCES:

1. John V. Guttag "Introduction to Computation and Programming using Python", The MIT press., 2016
2. Paul Gries, Jennifer Campbell, Jason Montojo "Practical Programming: An Introduction to Computer Science using Python 3", Pragmatic Programmers., 2013 , Second edition
3. Robert Sedgewick, Kevin Wayne, Robert Dondero "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India., 2016
4. Karl Beecher "Computational Thinking - A beginner's guide to problem solving and Programming", BCS Learning & Development., 2017

19IZ 105 ENGLISH LANGUAGE PROFICIENCY

2 1 0 3

LEARNING LANGUAGE THROUGH STANDARD LITERARY AND GENERAL TEXTS: Integrated tasks focusing on language skills; Training based on Text based vocabulary, tone, register and Syntax features (12 + 0)

GRAMMAR IN CONTEXT: Word Order; Subject Verb Concord; Style features - Tenses, Conditionals, Prepositions, Active and Passive Voice, Modals, Cloze and Spotting Error exercises (10 + 0)

GUIDELINES FOR WRITTEN COMMUNICATION: Principles of clear writing, Paragraph writing, Essay writing, Emphasis Techniques, Summarizing and Paraphrasing, Analytical writing (8 + 0)

FOCUS ON SPOKEN ENGLISH : Task – based activities: Graded levels of difficulty and with focus on language functions - Level 1: Self – expression – Greetings in Conversation, Hobbies, Special interests, Daily routine - Level 2: General Awareness – Expression of Concepts, Opinions, Social Issues, Description of a process / picture/chart, news presentation / review - Level 3: Advanced Skills – Making Short Speeches and Participating in Role Plays (0 + 10)

LISTENING ACTIVITY: Task based activities using Language Laboratory (0 + 5)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Faculty Incharge "Course Material on "English Language Proficiency", PSG College of Technology., Coimbatore, 2019

REFERENCES:

1. Jill Singleton "Writers at Work: The Paragraph", Cambridge University Press., New York, 2012
2. Simon Haines, Mark Nettle and Martin Hewings "Advanced Grammar In Use", Cambridge University Press., New Delhi, 2008
3. .Anne Laws "Writing Skills", Orient Black Swan., Hyderabad, 2011
4. Sinha DK "Specimens of English Prose", Orient Black Swan., Hyderabad, 2012

19IZ 110 BASIC SCIENCE LABORATORY

0 0 2 1

PHYSICS (ANY EIGHT EXPERIMENTS) :

1) Determination of Hysteresis loss of a ferromagnetic material
2) Determination of resistivity of metal and alloy using Carey Foster bridge
3) Determination of Temperature Coefficient of Resistance of metallic wire using post office box
4) Determination of capacitance using LCR bridge
5) Study of reverse bias characteristics of Germanium diode and determination of its band gap
6) Study of I-V characteristics of solar cell and determination of its efficiency
7) Thermistor: Measurement of temperature and band gap
8) Study of characteristics of Photo Diode
9) Operational Amp. (741) – Inverting and non inverting modes
10) Operational Amp. (741) – Integrator and differentiator

CHEMISTRY (ANY EIGHT EXPERIMENTS) :

1) Determination of hardness,TDS, pH and conductivity of a water sample.
2) Determination of molecular weight of polymers by Ostwald / Ubbelohde Viscometer.
3) Construction of phase diagram for eutectic system – for application in electronic cooling system.
4) Study of a galvanic cell.
5) Conductometric estimation of acid strength of a pickling bath.
6) Potentiometric estimation of ferrous ion in an effluent.
7) Anodizing of aluminium and determination of thickness of anodised film.
8) Preparation of chloride ion sensor by anodizing silver and calibration.
9) Electroplating of nickel & copper and determination of cathode efficiency.
10) Examination of different forms of corrosion using Ferroxyl indicator and determination of corrosion rate by current measurement.

(30)

Total P: 60

REFERENCES:

1. Department of Chemistry "Chemistry Laboratory Manual", ., 2019
2. Department of Physics "Physics Practicals", ., 2019
3. Wilson J. D., Hernandez C. A. "Physics Laboratory experiments", Houghton Miffin Company., New York, 2005

19IZ 111 ENGINEERING PRACTICES

0 0 4 2

MODULE 1 :

1) Foundry- Tools, preparation of moulding sand, patterns, cores, foundry exercises.
2) Welding - Metal arc welding tools and equipment, exercises on arc welding and MIG welding processes.
3) Fitting - Tools, operations, exercises on “T”-Joint and “L” Joint, types of joints.
4) Carpentry- Tools, carpentry process, exercises on types of joints.
5) Plumbing-Exercises on external thread cutting and joining.
6) Sheet metal work and soldering - Tools, operations, exercise on rectangular tray using Galvanized Iron sheet.

(15)

MODULE 2:

1) Study of passive and active components (resistors, capacitors, inductors, diodes and transistor).
2) Generation of Signals (DSO, Function generator).
3) Rectification of AC wave using bridge rectifier.
4) Construction of series and parallel circuits using resistors.
5) Assembling and disassembling of PC and troubleshooting.
6) Monitoring CPU Performance.

(15)

Total P: 30

REFERENCES:

1. Department of Mechanical Engineering "Engineering Practices Laboratory Manual", PSG College of Technology., Coimbatore, 2019
2. Chapman W.A.J "Workshop Technology", Edward Arnold., 2001
3. Hambley A R "Electrical Engineering Principles and Applications", PHI Learning Pvt. Ltd., New Delhi, 2017
4. Wikibooks Contributors "How to assemble your Desktop PC", Platypus Global Media., 2011
5. Govindarajalu B "IBM PC and CLONES : Hardware, Troubleshooting and Maintenance", TATA McGraw-Hill Education., 2008
6. Jeff Heaton "Build a Computer from Scratch", Heaton Research Inc., 2006

19IZ112 PYTHON PROGRAMMING LABORATORY

0 0 4 2

BASICS OF PROGRAMMING

1) Scratch Programming
2) Algorithm and Flow Chart

(24)

PROGRAMMING USING PYTHON :

1) Input/Output Statements and data types
2) Applications using Decision Making statements
3) Applications using Looping Statements
4) Applications using Set
5) Applications using Lists

6) Applications using Tuples
7) Applications using Dictionary
8) Applications using Functions
9) Applications using Modules
10) Applications using Files

(32)

DEBUGGING :

1) Application Debugging

(4)

Total P: 60

REFERENCES:

1.Charles Dierbach "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition., 2015
2. Kenneth Lambert "Fundamentals of Python: First Programs", Course Technology, Cengage Learning., 2016
3. John V Guttag "Introduction to Computation and Programming Using Python", MIT Press., 2015 , Revised and expanded Edition

SEMESTER - 2

19IZ 201 TRANSFORMS AND ITS APPLICATIONS

3 1 0 4

LAPLACE TRANSFORMS: Laplace transform, inverse transform, linearity, s-shifting, transforms of derivatives and integrals, unit step function, t – shifting, Dirac's delta function, periodic functions, differentiation and integration of transforms. (9 + 3)

APPLICATION OF LAPLACE TRANSFORMS: Convolution, solving differential equations with constant coefficients and variable coefficients, integral equations, systems of ODEs by using Laplace transform technique. (9 + 3)

Z TRANSFORMS: Z transform, inverse transform, shifting theorem, convolution theorem, initial and final value theorem, difference equation, application of Z transform to solve difference equations. (9 + 3)

FOURIER SERIES: Fourier series – even and odd functions, half range expansion, convergence of Fourier series, basic concepts of PDE's, wave equation, solution by separating variables, solution of one-dimensional heat equation and steady state two-dimensional heat equation.

(9 + 3)

FOURIER TRANSFORMS: Fourier integral, Fourier cosine and sine integrals, Fourier transform, Discrete Fourier transform, Fast Fourier transform – DIT algorithm.

(9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Erwin Kreyszig "Advanced Engineering Mathematics", John Wiley &Sons., New Delhi, 2015
2. Dean G.Duffy "Advanced Engineering Mathematics", CRC., USA, 2017

REFERENCES:

1. Peter V.O. Neil "Advanced Engineering Mathematics", Cengage., New Delhi, 2018
2. Wylie C. R. and Barrett L. C "Advanced Engineering Mathematics", Tata McGraw-Hill., New Delhi, 2019
3. Jain. R. K. and Iyenger. S. R. K. "Advanced Engineering Mathematics", Narosa Publishing House., New Delhi, 2018
4. Alexander D Poularikas "Transforms and Applications Primer for Engineers with Examples and MATLAB", CRC press., USA, 2010

19IZ 202 MATERIALS SCIENCE

3 0 0 3

QUANTUM MECHANICS : Wave particle duality, de Broglie waves- Heisenberg's uncertainty principle. Wave function- normalization. The wave equation. Schrodinger's equation of motion: Time dependent form, steady-state form. Particle in a box. Quantum Tunneling and applications to Scanning Tunneling Microscope and Tunnel diode. (9)

ELECTRICAL PROPERTIES : Conducting materials-quantum free electron theory -Fermi Dirac Statistics-Band theory of solids-the density of states. Dielectrics-types of polarization-measurement of dielectric permittivity-Loss factor-Dielectric loss mechanisms. Magnetostriction. Electron ballistics- materials for thermionic emission electron guns-electron gun for electron beam machining-electric discharge plasma-EDM machining. (9)

MAGNETIC PROPERTIES : Types of magnetic materials-domain theory-hysteresis- hard and soft magnetic materials-Applications-eddy current brakes, regenerative braking. Magnetic lenses. Superconductivity –Meissners effect- Josephson junction, SQUID magnetometer, applications of squid magnetometer- superconducting Magnets, and Magnetic levitation. (8)

PHYSICS OF SEMICONDUCTOR DEVICES : P type and N type semiconductors-the effective mass-P-N junction, rectifier equation -Hall effect-Quantum tunneling. Bipolar transistor. The field effect transistor- Integrated circuits— Hetero junction-Quantum well, wire, dots- Optical properties of Semiconductors: LD, LED, Photo diode. Introduction to MEMS (10)

STORAGE DEVICES : Computer Data Storage , Types of Storage , Primary Storage- RAM, ROM, Cache. Secondary Storage –Hard disk, Tertiary Storage – Magnetic tape, Compact disc, Digital versatile disc, Blue-ray. Off-line Storage – USB Flash drive, memory card. Storage Device Features. (9)

Total L: 45

TEXT BOOKS:

1. William D CallisterJr "Materials Science and Engineering-An Introduction", John Wiley and Sons Inc., NewYork, 2018 , tenth edition
2. Shaffer J P, Saxena A, Antolovich S D, Sanders T H Jr, Warner S B "The Science and Design of Engineering Materials", McGraw Hill Companies Inc., New york, 2000 , second editon

REFERENCES:

1. Arthur Beiser "Concepts of Modern Physics", Tata Mcgraw Hill., India, 2003 , sixth editon
2. Van Vlack "Elements Of Material Science And Engineering", Pearson Education., India, 2008 , sixth edition
3. Sze S.M "Physics of Semiconductor Devices", John Wiley and Sons., USA, 2007 , third edition
4. Donald R Askeland, Wendelin J Wright "Essentials of Materials Science and Engineering", Cengage Learning., 2013 , third edition
5. James F Shackelford S "Introduction to Materials Science for Engineers", Macmillan Publishing Company., New york, 2015 , eighth edition

19IZ 203 INDUSTRIAL ELECTROCHEMISTRY

2 0 0 2

ELECTROCHEMISTRY: Conductance of strong and weak electrolytes, mobility of ions - transport number, applications of conductance measurement. Electrode potential – standard and reference electrodes, Nernst equation, emf series – applications. Galvanic and concentration cells. Applications of emf measurements – glass electrode - pH measurement, potentiometric- redox titrations. (6)

CORROSION: Mechanisms - Galvanic and differential aeration corrosion. Corrosion rate – factors influencing corrosion - galvanic series. Corrosion control - corrosion inhibitors, cathodic protection -

sacrificial anode, current impression, conversion coatings – anodizing – determination of thickness of anodized film. Nature inspired coatings-superhydrophobic coatings, self-healing coatings. Corrosion in electronic components – control by vapour phase inhibitors. (6)

METAL FINISHING IN ELECTRONIC INDUSTRY : Electroplating – plating parameters- polarization and overvoltage, current and energy efficiency. Electroplating of Cu, Ni, and Cr. Electroless deposition of Ni and Cu. Production of plated through hole PCBs, electroforming - fabrication of CD stampers, electrochemical etching of Cu from PCBs, Electrophoretic painting, Electrochemical etching of semiconductors. (6)

ELECTROCHEMICAL POWER SOURCES: Batteries- types, characteristics. Fabrication and working of lechlanche cell, primary lithium cell, lead- acid battery, Ni-metal hydride and lithium ion batteries. Supercapacitors. Fuel cells - Classification, working principle, components, applications of proton exchange membrane, direct methanol and solid oxide fuel cells. Hydrogen as a fuel-production and storage. (6)

SENSORS : Components of electrochemical sensors, electrochemical transducers-potentiometric, amperometric and conductometric methods – ion-selective electrodes – solid-state electrode, liquid ion-exchange membrane electrodes. Gas sensors – CO2, O2 and NH3 sensing. Sensors for health care – glucose and urea. (6)

Total L: 30

TEXT BOOKS:

1. Derek Pletcher and Frank C. Walsh "Industrial Electrochemistry", Chapman and Hall., London, 1993. , second edition
2. John O'M.Bockris and Amulya K. N. Reddy "Modern Electrochemistry 2B", Kluwer Academic/Plenum Publishers., New York, 1998. , second edition

REFERENCES:

1. Dell R. M. and Rand D. A. J "Understanding Batteries", Royal Society of Chemistry., UK, 2001. , first edition
2. Brian Eggins "Chemical Sensors and Biosensors", John Willey & Sons., US, 2002. , first edition
3. Zaki Ahmad, Digby Macdonald "Principles of Corrosion Engineering and Corrosion Control", Butterworth- Heinemann., London, 2013. , second edition
4. Shashi Chawla "A Textbook of Engineering Chemistry", Dhanpat Rai and Co.., New Delhi, 2005. , first edition

19IZ 204 DIGITAL DESIGN

3 0 0 3

NUMBER SYSTEM AND BOOLEAN ALGEBRA : Number Systems and Number-Base Conversion - Complements of Numbers (Diminished Radix Complement, Radix Complement) - Signed Binary Numbers - Arithmetic Operation with the Binary Numbers - Binary Codes(BCD,8421 Code, Gray Code, ASCII) - Boolean Algebra - Basic Theorems and Properties of Boolean Algebra - Simplification of Boolean Functions - Canonical and Standard Forms – Other Logic Operations (12)

DESIGN OF COMBINATIONAL CIRCUITS : Introductory Digital Concepts - Digital Logic Gates - Karnaugh Map Method - Don't Care Conditions - The Tabulation Method - NAND and NOR Implementation - Design Procedure - Ad d e r - Subtractor - Magnitude Comparator - Decoders - Encoders - Priority Encoder - Multiplexers - Demultiplexers - Three State Gates - Design Examples (9)

SEQUENTIAL CIRCUITS : Introduction - Storage Elements: - Latch(S-R Latch, D-Latch) - Flip-Flops(S-R Flip Flop,D- Flip Flop, J-K Flip Flop, T-Flip Flop) - Master Slave Configuration of J-K Flip Flop - Shift Registers - Design of Asynchronous and Synchronous Counter (7)

DESIGN OF SEQUENTIAL CIRCUITS : Mealy and Moore Models of Finite State Machines(FSM) - Synchronous Sequential Logic - State Reduction and Assignment - Design Procedure - Algorithmic State Machines (ASMs) - Asynchronous Sequential Logic - Race Conditions - Design Procedure - Reduction of State and Flow Tables - Race Free State Assignment - Hazards - Design Examples (12)

MEMORY AND PROGRAMMABLE LOGIC : Introduction - Random Access Memory - Memory Decoding - Read Only Memory - Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Sequential Programmable Devices (5)

Total L: 45

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti "Digital Design: With an Introduction to the Verilog HDL, VHDL and System Verilog", Pearson Education., USA, 2018 , Sixth Edition
2. M. Morris Mano "Digital Logic and Computer Design", Pearson Education., India, 2017
3. Thomas L. Floyd "Digital Fundamentals", Pearson Education., USA, 2015

REFERENCES:

1. Charles H. Roth, Jr, Larry L. Kinney "Fundamentals of Logic Design", Cengage Learning., USA, 2014
2. John F. Wakerly "Digital Design: Principles and Practices", Pearson Education., USA, 2018
3. Roger L Tokheim "Digital Electronics: Principles and Applications", McGraw-Hill Education., USA, 2013
4. Ronald Tocci, Neal Widmer, Greg Moss "Digital Systems", Pearson Education., USA, 2016
5. Donald D. Givone "Digital Principles and Design", McGraw-Hill Education., USA, 2003

19IZ 205 C PROGRAMMING

2 2 0 4

C PROGRAMMING BASICS : Introduction to C programming - C Program Structure - Program Compilation & Execution - Character Set - Keywords - Data Types – Library functions - Control Statements: Branching and Looping. (3 + 4)

ARRAYS AND STRINGS: Single Dimensional Array, Two Dimensional Arrays, Multidimensional Array: Initialization, Unsized Array Initialization. - Strings: Defining, initializing of strings, Processing strings, Array of Strings. (5 + 6)

FUNCTIONS: Definition of Function - Prototypes - Storage Classes - Scope Rules - Recursion - Command Line Argument. (6 + 6)

POINTERS: Pointer Declaration - Operations on Pointer - Passing Pointers to a Function - Calling Function: Call by Value, Call by Address - Return Statement - Passing Arrays to Function - Pointers and One Dimensional, two dimensional Array - Array of Pointers - Dynamic Memory Allocation. (8 + 6)

STRUCTURES, UNION AND FILES : Definition - Processing a Structure - Typedef - Array of Structure, and Pointer to Structure - Passing Structure to Functions. - Self-Referential Structures - Nested Structures - Union - Introduction to Files - File Access - File Organization - File Operations. (8 + 8)

Total L: 30 +T: 30 = 60

TEXT BOOKS:

1. Byron S. Gottfried, Jitendar Kumar Chhabra "Programming with C", Tata McGraw Hill Publishing Company., New Delhi, 2018. , fourth edition
2. Kernighan B. W., Ritchie D. M. "C Programming Language (ANSI C)", Prentice Hall of India Private Limited., New Delhi, 2010 , second edition

REFERENCES:

1. Herbert Schildt "C – The Complete Reference", Tata McGraw Hill Publishing Company., New Delhi, 2010 , fourth edition
2. PradipDey and Manas Ghosh "Programming in C", Oxford University Press., New Delhi, 2018
3. Yashavant P. Kanetkar "Let Us C", BPB Publications., 2017 , 16th edition
4. H. M. Deitel, P. J. Deitel "C How to Program", Pearson Education., New Delhi, 2013. , seventh edition

19IZ 211 DIGITAL DESIGN LABORATORY

0 0 4 2

COMBINATIONAL AND SEQUENTIAL CIRCUITS:

1) Study of Digital IC Technologies
2) Verification of Logic Gates
3) Implementation of Boolean equations
4) Design and Implementation of Arithmetic Circuits
5) Implementation of Multiplexer and De-Multiplexer circuits
6) Implementation of Encoder and Decoder circuit
7) Implementation of Latches and Flip-Flops
8) Conversion between Flip-Flops
9) Implementation of Shift Registers
10) Design of Asynchronous and Synchronous Counters
11) Study of HDL
12) Implementation of Combinational and Sequential Circuits using HDL

(60)

Total P: 60

REFERENCES:

1. M. Morris Mano, Michael D. Ciletti "Digital Design: With an Introduction to the Verilog HDL, VHDL and System Verilog", Pearson Education., USA, 2018 , Sixth Edition
2. Thomas L. Floyd "Digital Fundamentals", Pearson Education., USA, 2015

19IZ 212 C PROGRAMMING LABORATORY

0 0 2 1

1. Working with RAPTOR Tool – Flowchart Interpreter
2. Simple programs to understand Operators and expressions.
3. Decision making Statements :simple if, if..else, nested if .. else,elseifladder, switch case
4. Loops : while , do..while, for
5. Implementation of one dimensional array
6. Implementation of two dimensional array
7. Working with Strings
8. Functions
9. Recursive functions
10. Structures: Arrays and Structures,Nested Structures
11. Structures and functions
12. Implementation of pointer and pointer arithmetic
13. Types of pointer:const pointer, pointer to a constant, void pointer, null pointer

Total P: 60

REFERENCES:

1. Deitel H. M. and Deitel P. J "C: How To Program", Prentice Hall of India., New Delhi, 2015
2. Ajay Mittal "Programming in C - A Practical approach", Pearson., New Delhi, 2010
3. Gottfried B "Programming with C", McGraw Hill Education., New Delhi, 2018
4. Herbert Schildt "C: The Complete Reference", McGraw Hill., New Delhi, 2017

19IZ 213 ENGINEERING GRAPHICS

0 0 4 2

INTRODUCTION:

1) Lettering practice
2) Geometric constructions
3) Dimensioning practice as per BIS conventions **(12)**

THEORY OF PROJECTION:

1) Projection of points and lines
2) Projection of planes
3) Projection of solids **(12)**

SECTIONS OF SOLIDS :

1) Sections of regular solids as per BIS conventions
2) Types of sections - sectional views of engineering components
3) Constructing sectional views **(12)**

DEVELOPMENT OF SURFACES:

1) Development of lateral surfaces of regular solids

2) Projection of truncated solids and simple engineering sheetmetal components **(12)**

ORTHOGRAPHIC PROJECTION :

1) Projection of simple engineering components and missing view exercises

2) Modeling of simple engineering components using CAD software **(12)**

Total P: 60

TEXT BOOKS:

1. Venugopal K, Prabhu Raja V "Engineering Graphics", New Age International Publishers., New Delhi, 2018 , Fifteenth Multi color edition P.I Varghese "Engineering Graphics", McGraw Hill Education India Pvt. Ltd., New Delhi, 2013

REFERENCES:

1. K C John "Engineering Graphics for Degree", PHI Learning private limited., 2009
2. Bureau of Indian Standards "Engineering Drawing Practices for Schools and Colleges SP 46-2003", BIS., New Delhi, 2004

SEMESTER III

19IZ 301 LINEAR ALGEBRA

3 1 0 4

VECTOR SPACE: General Vector Spaces - Real Vector Spaces -Euclidean N-Space - Subspaces - Linear Independence - Basis and Dimension. (9+3)

ERRORS: Errors in Numerical Procedures. (1+1)

SYSTEM OF LINEAR EQUATIONS: Direct Methods - NaiveGauss Elimination Method -Gauss Jordan Method -Crout's Method - Iterative Methods - Gauss-Jacobi Method -Gauss-Seidel Method - Convergence Criteria - Ill Conditioned Systems - Eigenvalues and Eigenvectors- Power Method - Jacobi Method. (8+6)

NONLINEAR EQUATIONS: Bisection Method -False Position Method -Newton's Method - Convergence Criteria -Bairstow's Method -Graeffe's Root Squaring Method. (6+5)

INTERPOLATION AND CURVE FITTING: Lagrange's Polynomials -Newton's Divided Differences - Evenly Spaced Data – Chebyshev interpolation - Curve Fitting - Using Principle of Least Squares Approximation. (5+4)

DIFFERENTIATION AND INTEGRATION: Numerical Differentiation - Numerical Integration- Newton-Cotes Formulae -Trapezoidal Rule -Simpson's 1/3 Rule -Simpson's 3/8 Rule -Gaussian Quadratures. (6+4)

ORDINARY DIFFERENTIAL EQUATIONS: Numerical Methods for Initial Value Problem - Taylor-Series -Euler and Modified Euler Method -Runge-Kutta Methods -Adams Moulton Method - Solution of Second Order Boundary Value Problem by Finite Difference Method. (10+7)

Total L: 45+T: 30=75

TEXT BOOKS:

1. Howard Anton and Chris Rorres, ―Elementary Linear Algebra Applications‖, Wiley India, New Delhi, 2011.
2. Curtis F Gerald and Patrick O Wheatly, ―Applied Numerical Analysis‖, Pearson Education,New Delhi, 2013.

REFERENCES:

1. David C Lay, ―Linear Algebra and its Applications‖, Addison-Wesley, Boston, 2014.
2. Steven C Chapra and Raymond P Canale, ―Numerical Methods for Engineers with Software and Programming Applications‖, Tata McGraw Hill,New Delhi, 2013.
3. Rizwan Butt, ―Introduction to Numerical Analysis using MATLAB‖,Infinity Science Press, Hingham, 2008.
4. Amparo Gil, Javier Segura, Nico M. Temme, Numerical Methods for Special Functions, SIAM publishers, USA, 2007.

19IZ 302 DATA STRUCTURES

4 0 0 4

I**NTRODUCTION**: Data Structures - Types of Data Structures - Abstract Data Types - Program Development Life Cycle - Algorithm - Characteristics - Complexity Analysis - Recurrence Relations - Asymptotic Notations. (6)

ARRAYS AND LINKED LISTS: Array Representation – Operations - Applications: Linear and Binary Search - Insertion Sort - Bubble Sort – Matrices - Special Matrices. Linked List Representation - Operations - Types - Applications: Polynomial Addition - Sparse Matrices - Garbage Collection and Compaction. (9)

STACKS AND QUEUES: Stack Representation - Operations - Applications -Expression Handling - Queue Representation - Operations - Types of Queues: Circular Queue – Deque - Priority Queue. (8)

TREES: Terminologies - Binary Trees: Types - Representation - Traversal - Binary Search Trees: Representation - Operation - Threaded Binary Trees. Binary Heaps - Heap Sort – Multiway Search Trees: B Trees – B+ Trees - Trie Structures - Applications: Expression Trees. (12)

GRAPHS: Graph Terminologies - Types of Graphs - Representation - Operations - Traversal Techniques: Breadth First Search - Depth First Search. Applications: Topological Sort. (6)

HASHING: Hash Table - Hash Functions - Resolving Collisions – Rehashing. (4)

Total L: 45

TEXT BOOKS:

1. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C‖, Second Edition, Pearson Education, 2010.
2. Venkatesan R and Lovelyn Rose S, ―Data Structures‖, Wiley India Pvt Ltd, New Delhi, 2015.

REFERENCES:

1. Salaria R S, ―Data Structues and Algorithms using C‖, Fifth Edition, Khanna Book Publishing, New Delhi, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, ―Fundamentals of Computer Algorithms‖, Second Edition, Universities Press, 2011.
3. Jean Paul Tremblay and Sorenson, ―An Introduction to Data Structures with Applications‖, McGraw Hill Publishing Company, New Delhi, 2012.
4. Aho, Hopcroft and Ullman, ―Data Structures and Algorithms‖, Pearson Education, 2011.

19IZ 303 COMPUTER ARCHITECTURE

3 1 0 4

COMPUTER ORGANIZATION & DESIGN: Stored program organization (Von Neumann architecture) - Computer Registers - Computer Instructions - Timing and Control (Hardwired and Micro programmed) - Instruction Cycle - Memory reference instructions - Input / Output Instructions - Quantitative Principles of computer design. (10 + 3)

PROCESSOR DESIGN : Stack organization - Instruction Formats - Addressing modes - Fixed point arithmetic: addition, subtraction, multiplication (booth's algorithm) and division (restoring and non restoring division algorithm) - RISC Vs CISC (9 + 3)

MEMORY AND I/O SYSTEMS : Memory Hierarchy - Associative Memory - Cache Memory - Mapping policies – Cache optimization; I/O Systems: Introduction-Interrupts-Modes of Transfer -DMA. (8 + 3)

PARALLELISM : Pipelining - Pipelining Hazards - Overcoming Hazards - Instruction Level Parallelism – Dependencies (10 + 3)

MULTIPROCESSOR SYSTEMS : Symmetric and Distributed shared memory architectures - Challenges – Cache Coherence - Snooping protocol. (8 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Morris Mano , "Computer System Architecture", Prentice Hall of India, Prentice Hall of India, 2007.
2. John L. Hennessey, David A. Patterson , "Computer Architecture: A Quantitative Approach", Elsevier India Pvt. Ltd, New Delhi, 2015.

REFERENCES:

1. Carl Hamacher , "Computer Organization", Tata McGraw Hill Publishing, New Delhi, 2002.
2. Kai Hwang , "Advanced Computer Architecture Parallelism, Scalability, Programmability", Tata Mc Graw Hill, New Delhi, 2010.
3. William Stallings , "Computer Organization and Architecture", Pearson Education / Prentice Hall of India, New Delhi, 2006.
4. Kai Hwang, Faye A Briggs , "Computer Architecture and Parallel Processing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.

19IZ 304 DISCRETE STRUCTURES

2 1 0 3

LOGIC: Propositional logic - propositional equivalences - predicates and quantifiers - rules of inference - normal forms. (6 + 3)

PROOF TECHNIQUES: Direct proofs - contraposition - contradiction - mathematical induction-program correctness. (6 + 3)

GROUP THEORY: Semi groups, monoids, groups, subgroups, cosets - Lagrange's theorem, group homomorphism – properties, permutation groups, normal subgroups. (6 + 3)

CODING THEORY : Hamming distance, error correction and detection, maximum likelihood decoding and minimum distance decoding, group codes – decoding – nearest neighbor decoding. (6 + 3)

RING THEORY : Rings, integral domains, fields, polynomial rings and polynomial codes. (6 + 3)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Kenneth H Rosen , "Discrete Mathematics and its Applications", Tata McGraw Hill, New Delhi, 2016.
2. Tremblay J P and Manohar R , "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw
Hill, New Delhi, 2017.

REFERENCES:

1. Ralph P Grimaldi , "Discrete and Combinatorial Mathematics - An Applied Introduction", Pearson, Addison Wesley, USA,
2017.
2. Herstein I N , "Topics In Algebra", Wiley India, New Delhi, 2013.
3. Bernard Kolman, Robert C Busby, Sharon Cutler Ross , "Discrete Mathematical Structures", Prentice Hall, New Delhi,
2015.
4. Liu C.L, Mohapatra D.P , "Elements of Discrete Mathematics: A computer oriented approach", Tata McGraw Hill, New
Delhi, 2017.

19Z305 OBJECT ORIENTED PROGRAMMING

3 0 0 3

OBJECT ORIENTED PROGRAMMING: Features of OOP - Abstraction - classes and Objects - Encapsulation - Inheritance - Polymorphism. (8)

JAVA FUNDAMENTALS : Characteristics of Java - Java development Kit - Java Virtual Machine - Java Runtime Environment - Java REPL Data types - variables - Arrays - operators - control statements - Classes and methods constructors - Inheritance - abstract class (10)

INTERFACES AND PACKAGES : INTERFACES: Defining and implementing interface - extending interfaces - PACKAGES : package structure - Member access - Importing Packages - String handling. (7)

EXCEPTION HANDLING AND I/O : Exception Types - Try Catch Block - Throw - Throws - Finally - User Defined Exceptions - Java Input and output - Streams - Reading/writing console I/O - Reading and Writing Files. (8)

JAVA ADVANCED FEATURES : Collections framework - Collection interfaces and classes - Working with Maps – Generic classes and methods - generic restrictions - Lambda Expressions - fundamentals - method and constructor references - Java Archives - JAR file creation and usage - Module - creation and execution (12)

Total L: 45

TEXT BOOKS:

1. Schildt H , "Java: The Complete Reference", 11th Edition, McGraw-Hill Education, 2018.
2. Deitel P and Deitel H , "Java: How to Program", 11th Edition, Prentice Hall, 2018.

REFERENCES:

1. Hortsmann CS and Cornell G , "Core Java: Volume 1 - Fundamentals", 11th Edition, Prentice Hall, 2018.
2. James Gosling, Bill Joy, Guy Steele, Gilad Bracha, Alex Buckley and Daniel Smith , "The Java Language Specification –
Java SE", 13th Edition, Oracle America Inc., USA, 2019.

3. Daniel liang L , "Introduction to Java Programming", 10th Edition, Pearson Education, New Delhi, 2015.
4. Matt Weisfeld , "The Object Oriented Thought Process", 5th Edition, Addison-Wesley Professional,US, 2019.

19IZ 306 ECONOMICS FOR ENGINEERS

3 0 0 3

INTRODUCTION : Definition - Nature and Scope - Central Problems of an Economy - Positive and Normative Economics– Micro Economics and Macro Economics, Significance of Economics, Economic Assumptions. (9)

THEORY OF CONSUMER BEHAVIOR : Utility - Indifference Curve Analysis - Properties, Consumer‘s Budget Line - Demand Analysis: Demand Function and Law of Demand, Elasticity of Demand. Demand forecasting using Econometric Techniques. Supply - Factors Affecting Supply, Market Equilibrium Price, Consumer Surplus. (9)

PRODUCTION, COST AND REVENUE: Production Function, Total Product, Average Product and Marginal Product, Returns to Scale. Costs, Nature of Costs, Short-run and Long-run Cost Curves, Revenue concepts. (9)

MARKET STRUCTURE : Types of Markets - Perfect Competition - Characteristics - Imperfect Competition: Monopoly Monopolistic Competition – Oligopoly and Duopoly - Price Discrimination and Product Differentiation under Different Markets - Price and Output Determination in Short run and Long run and profit maximization. (9)

PERFORMANCE OF AN ECONOMY (MACRO ECONOMICS): Demand and Supply of Money – Quantity Theory of Money, Banking - Functions of Commercial Banks and Central Bank - Inflation - Causes - Control Measures – National Income - Concepts - Methods of Calculating National Income - Problems in Calculating National Income. (9)

Total L: 45

TEXT BOOKS :

1. Varian H.R. , "Intermediate Microeconomics", East– West Press, New Delhi, 2014.
2. Dewett.K.K, Navalur. M.H. , "Modern Economic Theory", S. Chand, New Delhi, 2015.

REFERENCES :

1. William A, McEachern, Simrit Kaur , "Micro ECON", Cengage Learning, Noida, 2013.
2. William A, McEachern, Indira A. , "Macro ECON", Cengage Learning, Noida, 2014.
3. Deepashree , "Principles of Economics", Ane Books Pvt Ltd, New Delhi, 2010.
4. Dwivedi , "Essentials of Business Economics", Vikas Publishing House Pvt Ltd, New Delhi, 2010.

19IZ 310 DATA STRUCTURES LABORATORY

0 0 2 1

LIST OF EXPERIMENTS:

1. Solving Problems Using Arrays
2. Implementation of Linked List.
3. Applications of Linked List
4. Implementation of Stack
5. Applications of Stack
6. Implementation of Queue
7. Operations on Binary Search Trees.
8. Graphs - Depth First Search and Breadth First Search
9. Hashing and Collision Resolution
10. Sorting Algorithms

Total P: 60

REFERENCES:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, ―Fundamentals of Computer Algorithms‖, Second Edition, Universities Press, 2011.
2. Jean Paul Tremblay and Sorenson, ―An Introduction to Data Structures with Applications‖, McGraw Hill Publishing Company, New Delhi, 2012.
3. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, ―Introduction to Algorithms‖, MIT Press, England, 2009.
4. Venkatesan R and Lovelyn Rose S, ―Data Structures‖, Wiley India Pvt Ltd, New Delhi, 2015.

19IZ 311 OBJECT ORIENTED PROGRAMMING LABORATORY

0 0 2 1

LIST OF EXPERIMENTS :

1. Study of JDK,JRE,JVM, IDE
2. Study of REPL
3. Java Basics,Classes and Overloading
4. Inheritance,Overriding
5. Interfaces and packages
6. String handling
7. Exception Handling
8. IO Streams
9. IO Streams and Generics
10. Lambda Expression and Modules

Total P : 30

19IZ 312 ENVIRONMENTAL SCIENCE

2 0 0 0

INTRODUCTION TO ENVIRONMENT : Environment - Definition, scope and importance. Types and composition of atmosphere - particles, ions and radicals. Ozone layer- significance, formation and depletion. Ecosystems- Structure and functions, components, energy flow, food chains, food web, Biodiversity-levels, values and threats - India as a mega-diversity nation - hotspots of biodiversity - endangered and endemic species of India - conservation of biodiversity.

(6)

ENERGY RESOURCES: Introduction - National and International status- exploitation - sustainable strategies- Fossil fuelsclassification, composition, physico-chemical characteristics and energy content of coal, petroleum and natural gas; solar energy - introduction, harnessing strategies. Wind energy - availability, wind power plants, wind energy conversion systems, site characteristics, and types of wind turbines. Supporting renewable energy resources - tidal –geothermal - hydroelectric.

(6)

ENVIRONMENTAL POLLUTION: Definition - Sources, causes, impacts and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards (h) RF hazards - Role of an individual in prevention of pollution. DISASTER MANAGEMENT: Floods, earthquake, cyclone and landslides - Case studies, consequences and rescue measures

(6)

WASTE MANAGEMENT: Wastewater - Characteristics of domestic and industrial wastewater - COD and BOD - Various stages of treatment - primary, secondary, tertiary treatment- Biological and advanced oxidation processes. Solid waste management - Characteristics of municipal solid waste(MSW), biomedical, automobile and e-wastes and their management – landfills, incineration, pyrolysis, gasification and composting. (6)

SOCIAL ISSUES AND THE ENVIRONMENT: Environmentally Sustainable work practices- Rain water harvesting - Role of non-governmental organizations. Human ethics and rights- impact on environment and human health - role of information technology on environment and human kind. Green IT policies, Process of EIA - ISO 14000. Legislation- Environment protection act - Air (Prevention and Control of Pollution) act - Water (Prevention and control of Pollution) act - Wildlife protection act - Forest conservation act. (6)

Total L: 30

TEXT BOOKS :

1. Gilbert M.Masters , "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi, 2004.
2. De A K , "Environmental Chemistry", New Age International P Ltd, New Delhi, 2006.

REFERENCES :

1. Benny Joseph , "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
2. KoteswaraRao MVR , "Energy Resources: Conventional & Non-Conventional", BSP Publications, New Delhi, 2006.
3. Deswal S and Deswal A , "A Basic Course in Environmental Studies", Dhanpat Rai and Co, New Delhi, 2004.

SEMESTER IV

19IZ 401 PROBABILITY, STOCHASTIC PROCESSES AND STATISTICS

3 1 0 4

PROBABILITY: Probability Axioms - Conditional Probability - Law of Total Probability -Baye‘s Theorem – Independence. (4+4)

RANDOM VARIABLES: Discrete Random Variables: Probability Mass Function - Cumulative Distribution Function -Bernoulli - Binomial -Poisson and Geometric Random Variables. Continuous Random Variables: Probability Density Function - Uniform - Exponential -Gaussian and Gamma Random Variables - Expectations. (8+8)

PAIRS OF RANDOM VARIABLES: Joint Cumulative Distribution Function - Joint Probability Mass Function - Marginal Probability Mass Function - Joint Probability Density Function - Marginal Probability Density Function - Expected Values - Independent Random Variables - Covariance - Correlation. (8+5)

STATISTICAL INFERENCE: Estimation of a Random Variable - Linear Estimation of X given Y - MAP and ML Estimation - Simple Linear Regression and Multiple Linear Regression Model. (8+3)

HYPOTHESIS TESTING: Tests of statistical hypothesis, one-sided and two-sided hypothesis, confidence intervals, large and small sample tests, inference concerning means, variances and proportions - Chi-square test for goodness of fit and independence of attributes. (7+4)

STOCHASTIC PROCESSES: Types of Stochastic Processes – Poisson Process -Brownian Motion Process - Expected Value and Correlation - Stationary Processes - Wide Sense Stationary Stochastic Processes. (10+6)

Total L: 45+T: 30=75

TEXT BOOKS:

1. Roy D Yates and David J Goodman, ―Probability and Stochastic Processes - A friendly Introduction for Electrical and Computer Engineers‖, John Wiley & Sons, New Delhi, 2012.
2. Dougles C Montgomery and George C Runger, ―Applied Statistics and Probability for Engineers‖, Wiley, New Delhi, 2012.

REFERENCES:

1. Saeed Ghahramani, ―Fundamentals of Probability with Stochastic Processes‖, Prentice Hall, New Jersy, 2014.
2. Sheldon M Ross, ―Stochastic Processes‖, Wiley India Pvt. Ltd, New Delhi, 2008.
3. Athanasios Papoulis and Unnikrishna Pillai S, ―Probability, Random Variables and Stochastic Processes‖, Tata McGraw Hill, New Delhi, 2006.
4. Medhi J, ―Stochastic Processes‖, New Age International Publishers,New Delhi, 2014.

19IZ 402 DESIGN AND ANALYSIS OF ALGORITHMS

3 1 0 4

DIVIDE AND CONQUER: Methodology - Finding Maximum and Minimum Element - Quick sort - Merge sort - Matrix multiplication - Convex Hull. (5+5)

GREEDY METHOD: Greedy Strategy - Knapsack Problem - Minimum Spanning Trees - Single Source Shortest Path Method - Huffman Trees. (5+5)

DYNAMIC PROGRAMMING: Principle of Optimality - Knapsack Problem - All Pairs Shortest Path - Optimal Binary Search Tree - Multistage Graphs. (5+5)

BACKTRACKING: State Space Tree - Knapsack Problem - The Eight Queens Problem - Sum of Subset Problem - Graph Coloring. (6+6)

BRANCH AND BOUND: Bounding Functions - 0/1 Knapsack Problem - Traveling Sales Person Problem - Assignment Problem. (5+5)

NP HARD AND NP COMPLETE PROBLEMS:P – NP – Polynomial Time Reductions – NP Complete – NP Hard – Examples of NP Hard and NP Complete Problems. (4+4)

Total L: 30+T: 30=60

TEXT BOOKS:

1. Anany Levitin, ―Introduction to the Design & Analysis of Algorithms‖, Prentice Hall of India Pearson Education, New Delhi, 2011.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, ―Fundamentals of Computer Algorithms‖, Galgotia Publications, New Delhi, 2010.

REFERENCES:

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, ―Introduction to Algorithms‖, MIT Press, England, 2009.
2. Jon Kleinberg and Eva Tardos, ―Algorithm Design‖, Pearson Education, 2006.
3. Jeffrey J McConnell, ―Analysis of Algorithms‖, Jones and Bartlett Publishers, 2008.
4. Parag Himanshu Dave and Himanshu Bhalchandra Dave, ―Design and Analysis of Algorithms‖, Pearson Education, 2008.

19IZ 403 OPERATING SYSTEMS

3 0 0 3

I**NTRODUCTION**: Functions - History - Operating System Concepts - System Calls - Services - User Operating System Interface - Design and Implementation - Introduction to Virtual Machines. (6)

PROCESS MANAGEMENT: Process Model - Creation – Termination - Hierarchies - States - Implementation - Scheduling Criteria - Scheduling Algorithms - Multithreading Models - Thread Libraries - Threading Issues - Thread and Multiprocessor Scheduling Algorithms - Interprocess Communication. (10)

PROCESS SYNCHRONIZATION AND DEADLOCKS: Race Conditions - Critical Section - Mutual Exclusion - Peterson‘s Solution – Synchronization: Hardware - Semaphores - Mutex - Monitor - Message Passing, Dining Philosophers Problem - Readers Writers Problem. Deadlocks: Conditions - Detection - Recovery - Prevention - Avoidance. (9)

MEMORY MANAGEMENT: Main Memory: Swapping - Contiguous Memory Allocation - Paging - Structure of Page Table - Segmentation - Examples. Virtual Memory: Demand Paging - Copy on Write - Page Replacement - Allocation of Frames - Thrashing - Memory Mapped Files - Allocating Kernel Memory - Memory Management Utilities. (10)

STORAGE MANAGEMENT: Files: Naming - Structure - Types - Access - Attributes - Operations - Implementation. Directories: Operations - Path Names - Hierarchical Directory System - Implementation - Allocation Methods - Free Space Management - NFS - Efficiency and Performance - Recovery. Mass Storage:Disk Structure - Disk Scheduling Algorithms - Swap Space Management - Streams.Case Study: Linux. (10)

Total L: 45

TEXT BOOKS:

1. Silberschatz A, Galvin P and Gagne G "Operating Systems Concepts", John Wiley & Sons, USA, 2009.
2. Andrew S Tanenbaum and Herbert Bos, —Modern Operating Systems", Prentice Hall of India, New Delhi, 2015.

REFERENCES:

1. Andrew S Tanenbaum, —Modern Operating Systems Design and Implementation‖, Prentice Hall of India, New Delhi, 2009.
2. William Stallings, —Operating Systems: Internals and Design Principles‖, Pearson, 2013.
3. Gary Nutt, —Operating Systems‖, Addison Wesley, USA, 2009.
4. Harvey M Deitel, —Operating System‖, Prentice Hall of India, New Delhi, 2008.

19IZ 404 DATABASE MANAGEMENT SYSTEMS

3 0 0 3

INTRODUCTION TO DATABASE: File System Organization: Sequential - Pointer - Indexed – Direct. Purpose of Database System - Database Characteristics - Users of Database System - Advantages of DBMS Approach - Schemas and Instances - Three Schema Architecture and Data Independence - The Database System Environment - Relational Algebra. (8)

LOGICAL DATABASE DESIGN: Relational DBMS - Codd's Rule - Entity-Relationship model - Extended ER Normalization - Functional Dependencies - Anomaly - 1NF to 5NF - Domain Key Normal Form – Denormalization. (9)

SQL AND QUERY OPTIMIZATION: Concepts - Keys - Integrity Constraints - Domain Relational Calculus - Tuple Relational Calculus - SQL Fundamentals: DDL - DML - DCL - TCL - Views - Embedded SQL - Static Vs Dynamic SQL - Query Processing and Optimization. (8)

INDEXING: Types of Single Level Ordered Indexes - Multilevel Indexes - Dynamic Multilevel Indexes. (6)

TRANSACTION PROCESSING AND CONCURRENCY CONTROL: Transaction Concepts - ACID Properties - Transaction States - Concurrency Control Problems - Serializability - Recoverability - Pessimistic and Optimistic Concurrency Control Schemes. (8)

ADVANCED TOPICS: Overview: Parallel Database - Multimedia Database - Mobile Database - Web Database - Multidimensional Database. Data Warehouse - OLTP Vs OLAP - NoSQL Database. (6)

Total L: 45

TEXT BOOKS:

1. Abraham Silberchatz, Henry F Korth and Sudarshan S, —Database System Concepts‖, Tata McGraw-Hill, New Delhi, 2010.
2. Ramez Elmasri and Shamkant B Navathe, —Fundamentals of Database Systems‖, Addison Wesley, USA, 2010.

REFERENCES:

1. Raghu Ramakrishnan and Johannes Gehrke, —Database Management Systems‖, Tata McGraw-Hill, New Delhi, 2008.
2. Gupta G K, —Database Management System‖, Tata McGraw-Hill, New Delhi, 2011.
3. Atul Kahate, —Introduction to Database Management Systems‖, Pearson Education, New Delhi, 2009.

19IZ 405 SOFTWARE ENGINEERING

3 0 0 3

SOFTWARE PROCESS : The Evolving Role of Software - Software Characteristics - Software Applications - Software Myths - Software Process Models - The Linear Sequential Model - The Prototyping Model - The RAD Model - Evolutionary Software Process Models - The Incremental Model - Spiral Model - Agile Process Extreme Programming and Scrum. (8)

REQUIREMENTS ENGINEERING AND ESTIMATION : Functional requirements - Requirements Elicitation – Requirements Analysis and Negotiation - Requirements Validation - Requirements Management – Relationship between Size and Effort - Different techniques for Effort estimation - COCOMO - Function Point Analysis (10)

SOFTWARE ANALYSIS AND DESIGN : Analysis modeling - Translating Analysis Model into Design Model - Design Process - Modularity - Functional Independence - Cohesion - Coupling - Design Documentation – Software Architecture – User Interface Design (7)

TESTING TECHNIQUES : Software Testing Fundamentals - Test Case Design - White Box Testing - Black Box Testing - Testing for Specialized Environments - Testing Strategies - Unit Testing - Integration Testing – Validation Testing – System Testing Performance Testing - Case Study. (8)

SOFTWARE QUALITY ASSURANCE: Quality Concepts - Cost of Quality - Software Quality Group - Roles and Responsibilities of SQA Group - Formal Technical Reviews - Quality Standards - Software Configuration Management - Baselines - SCM Process - Version Control - Software Configuration Audit - Software Maintenance. (12)

Total L: 45

TEXT BOOKS:

1. Roger S Pressman , "Software Engineering - A Practitioner_s Approach", McGraw Hill International Edition, Singapore,
2015.
2. Pankaj Jalote , "A Concise Introduction to Software Engineering", Springer, New Delhi, 2011.

REFERENCES:

1. Ian Sommerville , "Software Engineering", Pearson Addison Wesley, Boston, 2017.
2. Shari Lawrence Pfleeger , "Software Engineering: Theory and Practices", Pearson, New Delhi, 2009.
3. James Peter, Pedrycz W , "Software Engineering: An Engineering Approach", John Wiley & Sons, 2007.
4. Glenford J Myers, Tom Badgett, Corey Sandler , "The Art of Software Testing", 3rd Edition, John Wiley & Amp sons Inc, New Jersy, 2015.

19IZ 410 OPERATING SYSTEMS LABORATORY

0 0 2 1

LIST OF EXPERIMENTS:

1. Linux Commands
2. Shell Programming
3. Process Management using System Calls: Fork, Exit, Getpid, Exit, Wait, Close, Stat
4. Interprocess Communication using Pipes, Shared Memory and Message Queues
5. CPU Scheduling Algorithms
6. Banker‘s Algorithm
7. Memory Management Schemes.
8. Page Replacement Algorithms
9. Mini File Manager – Open, Close, Read, Write, Seek, Delete
10. Disk Scheduling Algorithms

REFERENCES:

1. Silberschatz A, Galvin P and Gagne G "Operating Systems Concepts", John Wiley & Sons, USA, 2009.
2. Andrew S Tanenbaum and Herbert Bos, —Modern Operating Systems ", Prentice Hall of India, New Delhi, 2015.
3. Yashavant Kanetkar, —Unix Shell Programming‖, BPB Publications, New Delhi, 2003.
4. Mukhi and Gandhi, —The C Odyssey - Vol. III UNIX‖, BPB Publications, New Delhi, 2004.

19IZ 411 DATABASE MANAGEMENT SYSTEMS LABORATORY

0 0 2 1

LIST OF EXPERIMENTS:

1. Practice of SQL Commands (DDL,DML,DCL,TCL)
2. Practice of PL/SQL - (Cursors, Stored Procedures, Stored Function, Triggers, Packages).
3. Study of Open Source Databases
4. Mini Project (Application Development)

Total P: 30

REFERENCES:

1. George Koch and Kevin Loney, —Oracle 9i-The Complete Reference‖, Osborne McGrawHill, USA, 2009.
2. Rashmi Anandi, —Oracle 11i- The Complete Reference‖, Laxmi Publications, New Delhi, 2009.
3. Robin Nixon, —Learning PHP, MySQL, Java Script and CSS‖, O‘Reilly Media, USA, 2012.
4. Ivan Bayross —Sql, Pl/sql: The Programming Langage Of Oracle‖, Bpb Publications‖, New Delhi, 2003.

SEMESTER – 5

19IZ 501 THEORY OF COMPUTING

3 1 0 4

FINITE AUTOMATA: Need for automata theory - Finite Automaton - DFA and NFA - Finite Automaton with ε- moves - Regular Languages- Properties - Regular Expression - Equivalence of NFA and DFA - Equivalence of NFA's with and without ε-moves - Equivalence of finite Automaton and regular expressions – Minimization of DFA - Pumping Lemma for Regular sets.
(9 + 4)

GRAMMARS : Types of Grammar - Chomsky's hierarchy of languages - Context Free Grammars and Languages– Properties - Derivations and Languages – Ambiguity- Relationship between derivation and derivation trees – Simplification of CFG - Greiback Normal form - Chomsky normal form– pumping lemma for CFL. (8 + 2)

PUSH DOWN AUTOMATA: Definitions - Moves - Instantaneous descriptions - Deterministic and nondeterministic pushdown automata – Equivalence of Pushdown automata and CFL.
(8 + 4)

TURING MACHINE : Definitions of Turing machines - Models - Computable languages and functions –Turing machine construction - Multi head and Multi tape Turing Machines - The Halting problem.
(8 + 2)

UNSOLVABLE PROBLEMS AND COMPUTABLE FUNCTIONS : Unsolvable Problems and Computable Functions – Primitive recursive functions –PCP-MPCP- Recursive and recursively enumerable languages – Properties - Universal Turing machine - Measuring and classifying complexity- Tractable and Intractable problems- Tractable and possibly intractable problems – complexity classes - Polynomial time reductions – P and NP completeness – SAT problem - Clique problem - Space complexity. (12 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. John C Martin , "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw Hill Publishing
Company, New Delhi, 2011.
2. Hopcroft J.E., Motwani R. and Ullman J.D , "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, New Delhi, 2008.

REFERENCES:

1. Harry R Lewis and Christos H Papadimitriou , "Elements of the Theory of Computation", 2nd Edition, Prentice Hall of
India, New Delhi, 2015.
2. Peter Linz , "An Introduction to Formal Language and Automata", 6th Edition, Narosa Publishers, New Delhi, 2016.
3. Ganesh Gopalakrishnan , "Automata and Computability", 1st Edition, Chapman and Hall/CRC, USA, 2019.
4. D Shanthi, N Uma Maheshwari, S Jeyanthi , "Theory of Computation", 1st Edition, Yesdee, India, 2017.

19IZ 502 MICROPROCESSORS AND INTERFACING

3 0 0 3

ARCHITECTURE & PROGRAMMING OF 8086 : Architecture - Register Organization - Assembly Language Programming - The Instruction Set - Addressing Modes - Types Of Instructions - Data Transfer - Arithmetic - Logical - Shift And Rotate - Flag Control - Compare - Control Flow and Jump Instructions - Subroutine - Loop and String Handling Instructions. (10)

MEMORY INTERFACES : Signal Description - Hardware organization of the memory address space – Memory interface circuits - Bus Cycles - Minimum Mode and Maximum Mode (10)

I/O INTERFACES : I/O Addressing Capability - I/O Data Transfers and Instructions - Parallel Interface – 8255 Programmable Peripheral Interface - Serial Interface - 8251 Programmable Communication Interface (10)

INTERRUPT: Interrupt Mechanism - Types and Priority - Interrupt Vector Table - Interrupt Instructions - Enabling and Disabling of Interrupts - Hardware Interrupts - Software Interrupts - Internal Interrupts (8)

MODERN MICROPROCESSORS : Overview of Pentium Processor - Intel i3, i5, i7 processors - ARM Processor – Case study on Raspberry pi - Arduino - Intel Galileo (7)

Total L: 45

TEXT BOOKS:

1. Walter A Triebel, Avtar Singh , "The 8088 and 8086 Microprocessors – Programming, Interfacing, software, Hardware and Applications", Pearson Education, New Delhi, 2009.
2. Ray A K, Bhurchandi K M , "Advanced Microprocessors and Peripherals", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2009.

REFERENCES:

1. Barry B Brey , "Intel Microprocessors: 8086/8088, 80286, 80386, 80486, Pentium, Pentium Pro Processors, Pentium II, Pentium III and Pentium 4 : Architecture, Programming and Interfacing", Pearson Education, New Delhi, 2009.
2. Douglas V Hall , "Microprocessors and Interfacing", Tata Mcgraw Hill, New Delhi, 2009.
3. Steve Furber , "ARM System-On-Chip Architecture", Pearson Education Limited, USA, 2010.
4. Simon Monk , "Electronics Cookbook", 2nd Edition, O'Reilly Media, Inc., Boston, 2017.

19IZ 503 ARTIFICIAL INTELLIGENCE

3 0 0 3

INTRODUCTION : Artificial Intelligence - The state of art - Intelligent Agents - Rationality - Nature of Environments – Structure of Agents - Example problems (9)

PROBLEM SOLVING AGENTS : Searching for solutions: Uninformed search - BFS, DFS, Uniform cost search, Iterative deepening search - Informed Search - Greedy Best First search, A* search, AO* search - Adversarial search – Games - Optimal decisions in Games, alpha - beta pruning (9)

KNOWLEDGE AND REASONING : Logical Agents - First order logic, Inference in first order logic – Probabilistic Reasoning: Representing knowledge in uncertain domain - Bayesian Networks - Inference (9)

PLANNING AND LEARNING: Algorithms for Planning as state space search - Planning Graphs - Learning: Forms of learning - supervised learning, unsupervised learning, reinforcement learning - Reinforcement learning task - Q learning (9)

NATURAL LANGUAGE PROCESSING: Language models - Phrase structure grammars - Syntactic Analysis - Augmented Grammars and Semantic Interpretation (9)

Total L: 45

TEXT BOOKS:

1. Stuart J Russell and Peter Norvig , "Artificial Intelligence – A Modern Approach", 3rd Edition, Prentice Hall of India/Pearson Education, New Delhi, 2018.
2. Elaine Rich, Kevin Knight and Shivashankar B Nair , "Artificial Intelligence", 3rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017.

REFERENCES:

1. Tom Mitchell, "Machine Learning", McGraw Hill Education, New Delhi,, 2017.
2. George F Luger, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", 5th Edition, Pearson Education, New Delhi, 2017.
3. Nils J Nilsson, "Principles of Artificial Intelligence", Narosa Publishing House, New Delhi, 2002.
4. Patrick Henry Winston, "Artificial Intelligence", 3rd Edition, Pearson Education, New Delhi, 2013.

19IZ 504 COMPUTER NETWORKS

3 0 0 3

INTRODUCTION AND MEDIUM : Building a Network - Network Edge and Core - Layering and Protocols - TCP/IP Protocol suite - OSI Reference Model - Network Topologies - Internet Architecture–Physical Layer: Signal Characteristics – Transmission media – Signal Encoding Techniques – Performance Metrics. (10)

LINK LAYER SERVICES : Link Layer Services - Framing - Flow Control - Error Control - Media Access Control - Ethernet - Wireless LAN – Introduction about Bluetooth, Zigbee. (8)

SWITCHING AND ROUTING : Switching : Circuit Switching - Packet Switching - IPV4 - Global Address – Datagram Forwarding - Subnetting - CIDR - ICMP - Routing Algorithms: Distance Vector Routing and Link State Routing - IPV6 Addressing – IPV6 Protocol. (9)

CONNECTION-ORIENTED AND CONNECTION-LESS SERVICES : Overview of Transport Layer - UDP - TCP – Reliable Byte Stream - Connection Management - Flow Control - Congestion Control - SCTP. (9)

APPLICATION LAYER SERVICES : Needs/Principles of Application Layer Protocols – Role of proxy, Web and HTTP - FTP - Electronic Mail (SMTP - POP3 - IMAP - MIME) - DHCP - DNS - DASH - QUIC. (9)

Total L: 45

TEXT BOOKS:

1. Larry L Peterson, Bruce S Davie , "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann Publishers, USA, 2012.
2. James F Kurose, Keith W Ross , "Computer Networking - A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, New Delhi, 2017.

REFERENCES:

1. Prakash C Gupta , "Data Communication and Computer Networks", Prentice Hall of India, New Delhi, 2014.
2. Achyut S Godbole , "Data Communication and Networking", 2nd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.
3. Nader F Mir , "Computer and Communication Networks", Pearson Prentice Hall, New Delhi, 2014.
4. Andrew S Tanenbaum, David J Wetherall , "Computer Networks", 5th Edition, Prentice Hall of India/ Pearson Education, New Delhi, 2012.

19IZ 505 OBJECT ORIENTED ANALYSIS AND DESIGN

2 2 0 4

OBJECT MODEL: Complexity - Structure and Attributes of Complex Systems - Designing Complex Systems - Foundations of Object Models - Elements of an Object Model - Unified Software Development Process. (6 + 6)

UML AND USE CASE MODELING : Introduction - UML Views - Classification of UML Diagrams - Use Case Diagrams: Modeling Requirements - Components - Use Case Identification and Description - Use-Case Relationships (6 + 6)

BEHAVIORAL MODELING: Activity Diagram: Components - Construction. State Diagram: Components - Construction. Sequence Diagrams - Collaboration Diagrams - Timing Diagrams (6 + 6)

CLASSES AND OBJECTS: UML Class Diagrams - conceptual classes and description classes – Associations – Attributes - conceptual class Hierarchies - Aggregation and Composition- identification of analysis and design classes. (6 + 6)

STRUCTURAL DIAGRAMS AND PATTERNS : Package Diagram - Component Diagram - Deployment Diagram – Design Patterns MVC (6 + 6)

Total L: 30 +T: 30 = 60

TEXT BOOKS:

1. Booch G, Maksimchuk RA, Engel M W, Young B J, Conallen J, Houston K A , "Object Oriented Analysis and Design with Applications", 3rd Edition, Addison-Wesley, 2007.
2. Booch G, Rumbaugh J, Jacobson I , "The Unified Modeling Language User Guide", 2nd Edition, Addison Wesley Professional, 2005.

REFERENCES:

1. Bahrami A , "Object Oriented System Development - International Edition", McGraw Hill, 2007.
2. Pressman RS , "Software Engineering - A Practitioner‘s Approach", McGraw Hill, 2007.
3. Simon Bennett, Steve Mc Robb, Ray Farmer , "Object Oriented Systems Analysis and Design Using UML", 4th Edition, Mc-Graw Hill Education, 2010.
4. Craig Larman , "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd Edition, Pearson Education, 2005.

19IZ 510 COMPUTER NETWORKS LABORATORY

0 0 2 1

LIST OF EXPERIMENTS :

1. Study of Network Components,Basic Network Commands and Network Configuration Commands
2. Chat Program using TCP Sockets using C language
3. Sliding Window Protocol using TCP Sockets using C language
4. DNS using UDP Sockets using C language
5. Study of Wireshark Tool

6. Capturing of packet header at each layer using Wireshark
7. Tracing of TCP and UDP Connection using Wireshark
8. Study of any Simulator Tool
9. Performance comparison of TCP and UDP protocols using Simulation tool
10. Set up a typical network in a lab

Total P: 30

19IZ 511 MICROPROCESSORS AND INTERFACING LABORATORY

0 0 2 1

MICROPROCESSOR – 8086 :

1. Arithmetic operations
2. Recursion
3. Searching and Sorting
4. String Manipulations (14)

INTERFACING WITH 8086 :

1. Interfacing DAC/ADC
2. Keyboard/Display interfacing (6)

INTERFACING WITH ARM :

1. Study of ARM programming environment
2. Interfacing LED and Switch
3. Interfacing 4x4 Matrix Keypad Interfacing the LCD
4. Interfacing the LCD (10)

Total P: 30

19IZ 512 SOFTWARE PACKAGE DEVELOPMENT

0 0 4 2

PACKAGE DEVELOPMENT:

1. Problem identification - Requirements analysis and design - Implementation using coding standards - Library construction and usage - Testing and documentation.

Total P: 60

19IZ 513 BUSINESS AND MANAGERIAL COMMUNICATIONS

0 0 2 1

BUSINESS AND MANAGERIAL COMMUNICATIONS:

1. Advanced Group discussion
2. Advanced Resume writing
3. Mock Group discussion
4. Advanced Personal Interview
5. Mock Personal Interview
6. Cracking special Interviews
7. Essential Grammar for Placements
8. Vocabulary for Placements
9. Email writing
10. Paragraph writing
11. Essay writing

Total P: 30

REFERENCES:

1. Priyadarshi Patnaik , "Group Discussion and Interview Skills", Cambridge, New Delhi, 2011.
2. Hari Mohan Prasad, Rajnish Mohan , "How to Prepare for Group Discussion and Interview", 2nd Edition, Tata McGrawhill, New Delhi, 2009.

SEMESTER – 6

19IZ 601 MACHINE LEARNING

3 0 0 3

INTRODUCTION : Types of Learning - Designing a learning system - concept learning - Find-s Algorithm – Candidate Elimination - Data Preprocessing - Cleaning - Data Scales - Transformation - Dimensionality Reduction. (9)

LINEAR MODELS : Linear Regression Models ,Maximum Likelihood Estimation - Least Squares - Bias-Variance Decomposition - Bayesian Linear Regression - Linear Models for Classification, Probabilistic Generative Models - Probabilistic Discriminative Models - Linear Discriminant Analysis (9)

NEURAL NETWORKS AND DECISION TREES : Feed-forward Networks - Network Training - Delta Rule- Gradient Descent - Error Backpropagation - Regularization in Neural Networks - Generalisation - Decision Tree Learning- Representation - Inductive Bias- Issues (9)

KERNEL AND GRAPHICAL METHODS : Constructing Kernels - Radial Basis Function Networks – Gaussian Processes - Maximum Margin Classifiers - SVM - Bayes Theorem - Naive Bayes - Bayesian Networks (9)

UNSUPERVISED AND REINFORCEMENT LEARNING : Measures of Similarity and Dissimilarity - Clus tering – Partitioning methods - KMeans - Hierarchical Methods - Outliers - Reinforcement Learning - Reinforcement Learning Tasks - Q-learning (9)

Total L: 45

TEXT BOOKS:

1. Tom Mitchell , "Machine Learning", McGraw Hill, 2017.
2. Christopher M Bishop , "Pattern Recognition and Machine Learning Learning", Springer, 2011.

REFERENCES:

1. Ethem Alpaydin , "Introduction to Machine Learning", 3rd Edition, PHI Learning, 2015.
2. Trevor Hastie, Robert Tibshirani, Jerome friedman , "The Elements of Statistical learning", 2nd Edition, Springer, 2017.
3. Kevin Murphy , "Machine Learning - A Probabilistic Perspective", MIT Press, 2012.
4. Yaser S. Abu-Mostafa , "Learning from Data", AML, 2017.

19IZ 602 COMPILER DESIGN

3 1 0 4

INTRODUCTION TO COMPILERS : Translators - Compilation and Interpretation - The Phases of Compiler – Errors Encountered in Different Phases - The Grouping of Phases - Compiler Construction Tools - JIT. (7 + 2)

LEXICAL ANALYSIS : Need and Role of Lexical Analyzer - Input Buffering - Lexical Errors - Expressing Tokens by Regular Expression - Finite Automata: NFA- DFA - Converting NFA to DFA - Minimization of DFA- Converting Regular Expression to DFA. LEX Tool: Structure of LEX Program – Predefined Variables – Library routines – Design of Lexical Analyzer for a Sample Language. (9 + 3)

SYNTAX ANALYSIS : Need and Role of the Parser - Context Free Grammars - Top Down Parsing: Recursive Descent Parser - Predictive Parser. Bottom Up Parsers: Shift Reduce Parser - LR Parser - LR (0) Item - Construction of SLR Parsing Table - CLR Parser - LALR Parser. Error Handling and Recovery in Syntax Analyzer – YACC Tool: Structure of YACC Program – Communication between LEX and YACC - Design of a Syntax Analyzer for a Sample Language.

(10 + 5)

INTERMEDIATE CODE GENERATION : Benefits- Intermediate Languages - Generation of Three Address Code – Declarations - Assignment Statements - Arrays - Boolean Expressions - Backpatching - Flow of Control Statements – Procedure calls. (9 + 3)

RUN-TIME ENVIRONMENT, CODE OPTIMIZATION AND GENERATION : Source Language Issues – Storage Organization - Storage Allocation - Symbol Tables. Principal Sources of Optimization - Optimization of Basic Blocks - Global Optimization - Global Data Flow Analysis - Issues in Design of A Code Generator - A Simple Code Generator Algorithm. (10 + 2)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Alfred V Aho, Monica Lam, Ravi Sethi , Jeffrey D Ullman , "Compilers - Principles, Techniques and Tools", Essex Pearson, Harlow, 2014.
2. Sudha Sadasivam G , "Compiler Design", Scitech Publications (India) Private Limited, Chennai, 2010.

REFERENCES:

1. Dick Grone, Henri E Bal, Ceriel J H Jacobs , Koen G Langendoen , "Modern Compiler Design", John Wiley & Sons, USA, 2000.
2. Dhamdhere D M , "Compiler Construction Principles & Practice", Macmillan India Limited, New Delhi, 1997.
3. O.G. Kakde , "Compiler Design", 5th Edition, An Imprint of Laxmi Publications Pvt. Ltd., 2015.
4. V Raghavan , "Principles Of Compiler Design", Tata Mcgraw Hill Publishing Co Ltd, 2016.

19IZ 603 DISTRIBUTED COMPUTING

3 0 0 3

INTRODUCTION, MESSAGE PASSING AND RPC : Definition - System models - Design issues of distributed operating systems - Message Passing: Features and Issues–Buffering - Process addressing - Failure handling RPC: Model - Implementation - Stub generation - RPC Messages - Marshaling - Server management – Call semantics (10)

SYNCHRONIZATION : Clock synchronization - Physical clocks - Logical clocks - Election algorithms – Mutual exclusion – Deadlocks (8)

PROCESS AND RESOURCE MANAGEMENT: Process migration: Features - Mechanism. Resource Management: Load balancing approach - Load sharing approach (9)

CLOUD AS A DISTRIBUTED ENVIRONMENT : The Vision of Cloud Computing - Defining a Cloud - Historical Developments - Cloud Computing Reference Model –Cloud Deployment Models - Public, Private, Community, Hybrid Clouds - Cloud Delivery Models - IaaS, PaaS, SaaS - Characteristics and Benefits - Challenges. (8)

CLOUD TECHNOLOGIES : Technologies for Infrastructure as a service - Platform as a Service– Software as a service – Cloud Storage: MapReduce, GFS, HDFS - Cloud container: Docker.

(10)

Total L: 45

TEXT BOOKS:

1. Pradeep K Sinha , "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, New Delhi, 2009.
2. Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi S , "Mastering Cloud Computing", Tata McGraw Hill Education Private Limited,, New Delhi, 2013.

REFERENCES:

1. Andrew S Tanenbaum, Marteen Van Steen , "Distributed Systems Principles and Paradigms", Pearson Education / Prentice Hall of India, New Delhi, 2007.
2. George Coulouris, Jean Dollimore , "Distributed Systems Concept and Design", Pearson Education, New Delhi, 2006.
3. David S Linthicium , "Cloud Computing and SOA Convergence in your Enterprise", Pearson, USA, 2010.
4. Sébastien Goasguen , "Docker in the Cloud -Recipes for AWS, Azure, Google, and More", O'Reilly Media, USA, 2016.

19IZ 604 EMBEDDED SYSTEMS

2 2 0 4

INTRODUCTION : Fundamental Components of Embedded Systems - Challenges for Embedded Systems - Examples - Programming Languages - Recent Trends in Embedded Systems - Architecture of Embedded Systems - Embedded Design Life Cycle - Development Environment (7 + 4)

MEMORY AND INTERRUPTS : Types of Memory - Direct Memory Access - Memory Testing - Common Memory problems - validating memory contents - Interrupts - Interrupt Service Routines (6 + 6)

COMMUNICATION INTERFACES : Interfacing Buses - Serial Interfaces - RS232/UART - RS422/RS485 - I2C Interface - SPI Interface (6 + 7)

REAL TIME OPERATING SYSTEMS : Real-Time Concepts - Task Management - Task Scheduling - Classification of Scheduling Algorithms - Clock Driven Scheduling - Event Driven Scheduling - Resource Sharing – Priority Inheritance Protocol - Priority Ceiling Protocol - Commercial RTOS (7 + 7)

VALIDATION AND DEBUGGING : Host and Target Machines - Validation Types and Methods - Host Testing - Host- Based Testing Setup - Target Testing - Remote Debuggers and Debug Kernels - ROM Emulator - Logical Analyzer Background Debug Mode - In-Circuit Emulator (4 + 6)

Total L: 30 +T: 30 = 60

TEXT BOOKS:

1. Arnold S Berger , "Embedded Systems Design - An Introduction to Processes, Tools and Techniques", Elsevier, New Delhi, 2011.
2. Prasad K V K K , "Embedded/Real-Time Systems: Concepts, Design and Programming - The Ultimate Reference", Himal Impressions, New Delhi, 2003.

REFERENCES:

1. Sriram V Iyer, Pankaj Gupta , "Real-time Systems Programming", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.
2. Michael Barr, Anthony Massa , "Programming Embedded Systems: with C and GNU Development Tools", 2nd Edition, OReilly, 1999.
3. Michael J Pont , "Embedded C", Pearson Education, 2007.
4. Raj kamal , "Embedded Systems Design", 3rd Edition, Tata McGraw Hill, 2009.

19IZ 610 MACHINE LEARNING LABORATORY

0 0 2 1

LIST OF EXPERIMENTS:

1. Implementation of Uninformed search algorithms (BFS, DFS)
2. Implementation of Informed search algorithms (A*, AO*)
3. Min-Max Search Trees and Alpha Beta Pruning
4. Knowledge Representation and Reasoning
5. Data Preparation for Machine Learning
6. Linear models : linear regression and classification
7. Non-Linear models : ANN and Decision Tree
8. Kernel and Hybrid methods : SVM and Baysien Network
9. Unsupervised Learning : Outlier Detection and Clustering
10. Use Machine Learning for solving any problem with sufficient data.

Total P: 30

19IZ 611 DISTRIBUTED COMPUTING LABORATORY

0 0 2 1

LIST OF EXPERIMENTS:

1. Client Server Implementation using RPC
2. Implementation of Election algorithms.
3. Implementation of Distributed deadlock detection
4. Study of MPI
5. Simple application using MPI broadcasting (Matrix Multiplication, Pi calculation)
6. Point - to – Point application in MPI (Matrix Multiplication, Pi calculation)
7. Study of Hadoop & Map- Reduce Programming
8. Map- Reduce Programming on single files
9. Application development and deployment on cloud
10. Dockers

Total P: 30

19IZ 612 APPLICATION DEVELOPMENT LABORATORY

0 0 4 2

LIST OF EXPERIMENTS:

1. Create a simple webpage using HTML.
2. Use frames to Include Images and Videos in a web page.
3. Add a Cascading Style sheet for designing the web page
4. Design a dynamic web page with validation using JavaScript.
5. Design a Simple web application using Servlets.
6. Study of mobile computing, android operating system and ios
7. Develop an application that uses GUI components, Font and Colors.
8. Develop an application that uses Layout Managers and event listeners.
9. Write an android application that draws basic graphical primitives on the screen.
10. Develop an application that makes use of mobile database.

Total P: 60

REFERENCES:

1. Matt Neuburg , "Learning Web App Development: Build Quickly with Proven JavaScript Techniques", 1st Edition, O'Reilly Media, 2018.
2. Jr. Annuzzi Joseph, Lauren Darcey, Shane Conder , "Introduction to Android Application Development: Android Essentials (Developer's Library)", 5th Edition, Addison-Wesley Professional, 2016.
3. K Talukder, Hasan Ahmed, Roopa Yavagal , "Mobile Computing: Technology, Applications and Service Creation by Asoke", 2nd Edition, McGraw Hill Education, 2017.
4. John Ray , "iOS 9 Application Development in 24 Hours", 7th Edition, Sams Publishing, 2016.

19IZ 620 INNOVATION PRACTICES

0 0 4 2

INNOVATIVE PRACTICES :

1. This course involves preparing students to think innovatively and present possible solutions to identified industry/academic problem or issue

Total P: 60

INNOVATIVE TEXTILES

COURSES OF STUDY AND SCHEME OF ASSESSMENT

Code No.	Course Title	Periods / week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	FE	Total
SEMESTER I								
19IT 101	Calculus and Geometry	3	1	0	4	50	50	100
19IT 102	Physics	3	0	0	3	50	50	100
19IT 103	Chemistry	3	0	0	3	50	50	100
19IT 104	Basics of Textile Engineering	3	0	0	3	50	50	100
19IT 105	English Language Proficiency	2	1	0	3	50	50	100
19IT 110	Engineering Practices	0	0	2	1	50	50	100
19IT 111	Basic Sciences Laboratory	0	0	4	2	50	50	100
19IT 112	C Programming Laboratory	0	0	4	2	50	50	100
19IG 065	German Language – A1	12	0	0	4	-	100	100
SEMESTER 2								
19IT 201	Linear Algebra and Transforms	3	1	0	4	50	50	100
19IT 202	Material Science	2	0	0	2	50	50	100
19IT 203	Polymer and Fibre Chemistry	3	0	0	3	50	50	100
19IT 204	Basics of Electrical and Electronics Engineering	3	0	0	3	50	50	100
19IT 205	Applied Mechanics	2	1	0	3	50	50	100
19IT 211	Engineering Graphics	0	0	4	2	50	50	100
19IT 212	Fibre Analysis Laboratory	0	0	2	1	50	50	100
19IT 213	Internship 1	0	0	0	2	100	-	100
19IT 066	German Language – A2	12	0	0	4	-	100	100
SEMESTER 3								
19IT 301	Numerical Methods	2	1	0	3	50	50	100
19IT 302	Theory of Machines	3	1	0	4	50	50	100
19IT 303	Measurements and Instrumentation	3	0	0	3	50	50	100
19IT 304	Fibre Physics	3	0	0	3	50	50	100
19IT 305	Spun Yarn Technology I	3	0	0	3	50	50	100
19IT 306	Economics for Engineers	3	0	0	3	50	50	100
19IT 310	Electrical and Electronics Engineering Laboratory	0	0	4	2	50	50	100
19IT 311	Spun Yarn Technology Laboratory I	0	0	4	2	50	50	100
19IT 312	Environmental Science	2	0	0	0	100	-	100
19IT 067	German Language – B1	12	0	0	4	-	100	100

SEMESTER 4								
19IT 401	Probability and Statistics	2	1	0	3	50	50	100
19IT 402	Technology of Manufactured Fibres	2	0	0	2	50	50	100
19IT 403	Spun Yarn Technology II	2	1	0	3	50	50	100
19IT 404	Weaving Technology I	3	0	0	3	50	50	100
19IT 405	Technology of Nonwoven Fabrics	3	0	0	3	50	50	100
19IT 406	Knitting Technology	3	0	0	3	50	50	100
19IT 410	Spun Yarn Technology Laboratory II	0	0	4	2	50	50	100
19IT 411	Weaving Technology Laboratory	0	0	4	2	50	50	100
19IG 067	German Language – B1	12	0	0	4	-	100	100

DETAILED SYLLABI

SEMESTER - 1

19IT 101 CALCULUS AND GEOMETRY

3 1 0 4

THREE-DIMENSIONAL ANALYTICAL GEOMETRY: Direction cosines and ratio's, angle between two lines, equation of a plane, equation of a straight line, shortest distance between two lines. Equation of a sphere, plane section of a sphere. (9 + 3)

DIFFERENTIAL CALCULUS: Functions of two variables, limits and continuity, partial derivatives, the chain rule, extreme values and saddle points, Taylor's formula for two variables. (9 + 3)

INTEGRAL CALCULUS: Double integrals, double and iterated integrals over rectangles, double integrals over general regions, Fubini's theorem, area and volume by double integration, reversing the order of integration. (9 + 3)

ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER: Basic concepts, separable differential equations, exact differential equations, integrating factors, linear differential equations, modeling - mixing problems, decay and growth problems, Newton's law of cooling. (9 + 3)

LINEAR DIFFERENTIAL EQUATIONS OF SECOND ORDER : Homogeneous linear equations of second order, homogeneous linear ODEs with constant coefficients, finding a basis if one solution is known, Euler – Cauchy equation, solution by variation of parameters. (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Joel Hass, Christopher Heil, Maurice D. Weir "Thomas' Calculus", Pearson Education., New Delhi, 2018
2. Erwin Kreyszig "Advanced Engineering Mathematics", Wiley India Pvt Ltd., New Delhi, 2015

REFERENCES:

1. Howard Anton, Irl Bivens, Stephen Davis "Calculus", John Wiley &Sons, INC., USA, 2016
2. Wylie C R and Barrett L C "Advanced Engineering Mathematics", Tata McGraw-Hill., New Delhi, 2019
3. Vittal. P.R "Analytical Geometry 2D and 3D", Pearson Education., Chennai, 2013
4. Gilbert Strang "Calculus", Wellesley Cambridge Press., USA, 2017

19IT 102 PHYSICS

3 0 0 3

MECHANICAL PROPERTIES: Review of vector quantities. Newton's third law and Free Body diagrams. Rigid body dynamics: Centre of mass. Moment of inertia. Torque, angular momentum and angular acceleration. Work power and energy. Conservation of momentum. Friction and wear-Static and dynamic friction, limiting friction, Rolling friction. Coefficient of static friction, coefficient of dynamic friction. Lubrication and lubricants. Surface wear due to friction. Role of friction in textiles. Surface treatments for reducing friction. Surface treatments for increasing friction. (9)

PROPERTIES OF FLUIDS: Surface tension: molecular forces-intermolecular range. Excess pressure, capillarity. Viscosity -viscous force-coefficient of viscosity. Equation of continuity. Adhesion, cohesion, wettability. Fluid Motion- Newtonian and non-Newtonian fluids - Kinematics of Moving Fluids: Poiseuille's Equation for flow of a Liquid through a capillary tube. Properties of absorbent textiles for industrial applications (9)

GEOMETRICAL OPTICS: Image formation using lenses and mirrors. Spherical and chromatic aberration. Methods of reducing aberrations. Aspherical components, aperture control, multiple elements. Adaptive optics. Definition of depth of field. Optical instruments for imaging and inspection of textiles and fibres. Factors affecting magnification and image quality (8)

PHYSICAL OPTICS: Principle of Interferometry. Interferometric techniques for measurement of small thicknesses. Applications to measurement of fibre thickness and uniformity. Polarized light - appearance of transparent materials in polarized light- fibre colour due to birefringence. Polarized light microscopes for inspection of textiles and fibres. Use of Bertrand lens and conoscopy. Spectral distribution: emission, transmission reflection and absorption spectra. Textile colour, colour changing fabrics. (10)

THERMAL PHYSICS: Review of thermal properties: Specific heat capacity, thermal capacity and coefficient of linear thermal expansion. Methods of measurement of thermal expansion. Differential equation of one-dimensional heat flow. Searle's apparatus and Lee's disc apparatus for determination of thermal conductivity. Thermal Insulation. Convection and radiation. Heat dissipation. Properties of woven and non-woven textiles for thermal functions. (9)

Total L: 45

TEXT BOOKS:

1. Richard Wolfson "Essential university Physics", Pearson Education, Singapore., 2011
2. D Halliday and R. Resnick "Fundamentals of Physics", John Wiley and Sons., 2015

REFERENCES:

1. Gaur R K and Gupta S L "Engineering Physics", Dhanpat Rai and Sons, India., 2013
2. Hitendra K Malik, Ajay Kumar Singh "Engineering Physics", Tata McGraw-Hill Publishing Co. Ltd, India., 2017 , 2nd
3. Mathur D. S "Elements of Properties of Matter", S Chand and Co., 2013
4. Raymond A Serway, John W. Jewett "Physics for Scientists and Engineers", Cengage Learning., 2010

19IT 103 CHEMISTRY

3 0 0 3

CHEMICAL BONDING: Types of chemical bonds –bond polarity, dipole moments and partial ionic character of covalent bonds. Metallic bonding –free electron theory a n d band theory. Hydrogen bonding –types and their consequences. van der Waals forces –origin and significance. Significant organic functional groups in textiles. Properties of textiles related to structure and bonding - stretchability, dyeability, absorbency, crystallinity and strength- cotton wool, silk and polyester. (9)

KINETICS AND SURFACE CHEMISTRY: Review of Integrated rate laws-temperature dependence of reaction rate, homogenous and heterogenous catalysis, kinetics of enzyme catalysis–Michaelis-Menton equation. Adsorption - Freundlich and Langmuir isotherms. Surface active agents -types, orientation of surfactants o n s olid and liquid interfaces, adsorbed m ono layers, Critical micelle concentration. Applications of adsorption –detergency, water repellency, wetting -contact angle, foaming, emulsifiers-zeta potential, hydrophile- lipophile balance, deemulsification, defoamers and water conservation. (9)

WATER CHEMISTRY: Water quality parameters-determination of hardness (EDTA method), alkalinity, TDS, BOD, COD, chloride, sulphate, estimation of iron by colorimetry. Boiler troubles and remedies –internal conditioning. Water treatment methods –zeolite, demineralization, electrodialysis and reverse osmosis. Solution chemistry - solubility product, common ion effect-influence on ionization of weak electrolytes and pH of solutions. (9)

OILS, FATS, SOAPS AND LUBRICANTS: Oil and fats -chemical constitution, general chemical characteristics - drying, rancidification, hydrolysis, hydrogenation, hydrogenolysis. Chemical analysis –acid, saponification, iodine, R M values –determination a n d their significance. Soaps and detergents-types and preparation. Lubricants - Mechanism of lubrication, properties of lubricating oil -viscosity, viscosity index, flash and fire points, oiliness, cloud and pour points, aniline point, steam emulsion number, oxidation stability. Additives for lubricants. Greases –types and uses. Solid lubricants. (9)

DYES: Theory of colour and constitution–chromophore and auxochromes. Optical brightening agents. Nomenclature of dyes -commercial naming, colour index. Classification of dyes based on chemical structure and application. Chemistry of dye Intermediates - nitration,halogenation, sulphonation, Friedel- Crafts reaction, hydrolysis, oxidation, reduction and diazotization. Intermediates from benzene, naphthalene and anthracene. Synthesis of metanil yellow, congo red, malachite green, alizarin and indigo. (9)

Total L: 45

TEXT BOOKS:

1. Puri B. R, Sharma L. R, Pathania M. S "Principles of Physical Chemistry", Vishal Publishing & Company., New Delhi, 2010. , 1st ed
2. Jain P. C, Monica Jain "Engineering Chemistry", Dhanpat Rai Publishing Company., New Delhi, 2013. , 1st ed

REFERENCES:

1. Peter Atkins, Julio de Paula "Elements of Physical Chemistry", Oxford University Press., UK, 2013. , 6thed
2. Chatwal G. R "Synthetic Organic Chemistry", Himalaya Publishing House., Mumbai, 2001. , 1st ed
3. Shashi Chawla "A Text book of Engineering Chemistry", Dhanpat Rai & Company., New Delhi, 2005. , 1st ed
4. Shaw D. J "Introduction to Colloids and Surface Chemistry", Butterworth -Heinemann Ltd., Jordan, 1998. , 1st

19IT 104 BASICS OF TEXTILE ENGINEERING

3 0 0 3

TEXTILES: Apparels, Home Textiles and Technical textiles. Materials, Structure and properties based on end uses. Fabric type –Woven, Knitted and Nonwovens. Process flow chart. (9)

YARN: Classification of yarns – staple spun, continuous filament, textured yarn, fancy, composite, hybrid and plied. Structure and properties based on end uses. Process flow chart. Yarn Numbering systems. (9)

FIBRES: Classification of textile fibers. Extraction, structure, properties and end uses of natural fibers – C o t t o n , Wool, Silk, Jute, Flax, Hemp Coir, Sisal and Banana. (9)

MANUFACTURED FIBRES: Classification. Raw material, spinning process, process flow chart, structure , properties and end uses of Viscose, Polyester, Nylon, Acrylic, Polypropylene. Identification of textile fibres – Feeling Test, burning test, Microscopic test, Staining Test. Chemical test and Density measurement. (13)

CURRENT TRENDS: : Research and development of textile machineries and products. Self study topics. (5)

Total L: 45

TEXT BOOKS:

1. Mathews Kolanjikombil "The Substrates - Fibres, Yarn and Fabric", Woodhead publishing India., India, 2018 , 1
2. Sreenivasamurthy H. V. "Introduction to Textile Fibres", The Textile Association India., Mumbai, India, 1998

REFERENCES:

1. Bernard P. Corbman "Textiles : Fibre to Fabric", McGraw Hill Book Co., Singapore, 1983
2. Mishra S. P "A Text Book of Fibre Science and Technology", New Age International (P) Ltd., New Delhi, India, 2000
3. Marjory L. Joseph "Essentials of Textiles", CBS College Publishing., New York, 1984
4. Oxtoby E "Spun Yarn Technology", Butterworths., London, 2002

19IT 105 ENGLISH LANGUAGE PROFICIENCY

2 1 0 3

LEARNING LANGUAGE THROUGH STANDARD LITERARY AND GENERAL TEXTS : Integrated tasks focusing on language skills ; Training based on Text based vocabulary, tone, register and Syntax features (12 + 0)

GRAMMAR IN CONTEXT: Word Order ; Subject Verb Concord ; Style features - Tenses, Conditionals, Prepositions, Active and Passive Voice, Modals, Cloze and Spotting Error exercises (10 + 0)

GUIDELINES FOR WRITTEN COMMUNICATION : Principles of clear writing, Paragraph writing, Essay writing, Emphasis Techniques, Summarizing and Paraphrasing, Analytical writing (8 + 0)

FOCUS ON SPOKEN ENGLISH : Task – based activities: Graded levels of difficulty and with focus on language functions - Level 1: Self – expression – Greetings in Conversation, Hobbies, Special interests, Daily routine - Level 2: General Awareness – Expression of Concepts, Opinions, Social Issues, Description of a process / picture/chart, news presentation / review - Level 3: Advanced Skills – Making Short Speeches and Participating in Role Plays (0 + 10)

LISTENING ACTIVITY : Task based activities using Language Laboratory (0 + 5)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Faculty Incharge "Course Material on "English Language Proficiency", PSG College of Technology., Coimbatore, 2019

REFERENCES:

1. Jill Singleton "Writers at Work: The Paragraph", Cambridge University Press., New York, 2012
2. Simon Haines, Mark Nettle and Martin Hewings "Advanced Grammar In Use", Cambridge University Press., New Delhi, 2008
3. Anne Laws "Writing Skills", Orient Black Swan., Hyderabad, 2011
4. Sinha DK "Specimens of English Prose", Orient Black Swan., Hyderabad, 2012

19IT 110 ENGINEERING PRACTICES

0 0 2 1

1) Welding - Metal arc welding tools and equipment, exercises on arc welding and MIG welding processes.
2) Fitting - Tools, operations, exercises on “T”-Joint and “L” Joint, types ofjoints.
3) Carpentry - Tools, carpentry process, exercises on types of joints.
4) Plumbing - Exercises on external thread cutting and joining.
5) Sheet metal work and Soldering - Tools, operations, exercise on rectangular tray using galvanized iron sheet.

(15)

Total P: 15

19IT 111 BASIC SCIENCES LABORATORY

0 0 4 2

PHYSICS LABORATORY (ANY EIGHT EXPERIMENTS) :

1. Determination of Young’s Modulus of a wooden bar – Cantilever
2. Determination of rigidity modulus of a given material using Torsion pendulum
3. Determination of coefficient of viscosityof water – Poiseuille’s method
4. Determination of surface tension of water – Capillary rise method
5. Determination of Surface tension – Drop weight method
6. Determination of thermal conductivity of bad conductor using Lee’s Disc method
7. Determination of Specific Heat of solids –Calorimeter
8. Determination of fibre thickness – air wedge method

9. Determination of wavelength of mercury spectrum using transmission grating
10. Determination of lattice constant using X-ray powder photograph

(30)

CHEMISTRY(ANY EIGHT EXPERIMENTS) :

11. Estimation of hardness of water by EDTA method.
12. Determination of pH, alkalinity and COD of water sample.
13. Study of viscosity of lubricating oil using Redwood viscometer.
14. Determination of Flash and Fire points & Cloud and Pour points of a lubricating oil.
15. Determination of acid value, saponification value and iodine value of a vegetable oil.
16. Determination of CMC of a surfactant by conductometry.
17. Estimation of strength of commercial acid and purity of washing soda.
18. Estimation of strength of hydrogen peroxide solution.
19. Estimation of available chlorine in the hypochlorite solution.
20. Removal of dye from textile effluent using adsorbents.

(30)

Total P: 60

REFERENCES:

1. Department of Chemistry "Chemistry Laboratory Manual", ., 2019
2. Department of Physics "Physics Practicals", ., 2019
3. Wilson J. D. and Hernandez C. A. "Physics Laboratory Experiments", Houghton Miffin Company, New York., 2009

19IT 112 C PROGRAMMING LABORATORY

0 0 4 2

1) Working with RAPTOR Tool – Flowchart Interpreter
2) Simple programs to understand Operators and expressions.
3) Decision making Statements :simple if, if..else, nested if .. else,elseifladder, switch case
4) Loops : while , do..while, for
5) Implementation of one dimensional array
6) Implementation of two dimensional array
7) Working with Strings
8) Functions
9) Recursive functions
10) Structures: Arrays and Structures,Nested Structures
11) Structures and functions
12) Implementation of pointer and pointer arithmetic
13) Types of pointer:const pointer, pointer to a constant, void pointer, null pointer

(60)

Total P: 60

REFERENCES:

1. Deitel H. M. and Deitel P. J "C: How To Program", Prentice Hall of India., New Delhi, 2015
2. Ajay Mittal "Programming in C - A Practical approach", Pearson., New Delhi, 2010
3. Gottfried B "Programming with C", McGraw Hill Education., New Delhi, 2018
4. Herbert Schildt "C: The Complete Reference", McGraw Hill., New Delhi, 2017

SEMESTER - 2

19IT 201 LINEAR ALGEBRA AND TRANSFORMS

3 1 0 4

LINEAR EQUATIONS : Systems of linear equations, solving a linear system, existence and uniqueness of solutions, solutions of homogeneous and non homogeneous linear systems, applications of linear systems in economics and network flow, linear independence. (9 + 3)

EIGENVALUES AND EIGENVECTORS: Eigenvalues and eigenvectors of a real matrix – characteristic equation, properties of eigenvalues and eigenvectors, diagonalization, quadratic forms, reduction to canonical form by orthogonal reduction, applications of eigenvalues in population models and a predator-prey system. (9 + 3)

Z TRANSFORMS : Z transform, inverse transform, shifting theorem, convolution, initial and final value theorem, application of Z transform to solve difference equations. (9 + 3)

LAPLACE TRANSFORMS: Laplace transform, linearity, first shifting theorem, transforms of derivatives and integrals, ODEs, unit step function, second shifting theorem, Dirac's delta function, periodic functions. (9 + 3)

FOURIER TRANSFORMS: Fourier transform, Fourier cosine and sine transforms, discrete Fourier transform, Fast Fourier transform – DIT algorithm. (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Erwin Kreyszig "Advanced Engineering Mathematics", John Wiley &Sons., New Delhi, 2015
2. David C. Lay "Linear Algebra and its Applications", Pearson Education, Inc., Chennai, 2016

REFERENCES:

1. Wylie C R and Barrett L C "Advanced Engineering Mathematics", Tata McGraw-Hill., New Delhi, 2019
2. Jain. R. K., Iyenger, S. R. K. "Advanced Engineering Mathematics", Narosa Publishing House., New Delhi, 2018
3. Alexander D. Poularikas "Transforms and Applications Primer for Engineers with Examples and MATLAB®", CRC Press., 2010
4. Howard Anton and Chris Rorres "Elementary Linear Algebra", John Wiley and Sons., New Delhi, 2018

19IT 202 MATERIALS SCIENCE

2 0 0 2

CRYSTAL STRUCTURE: Solids :- Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Unit Cell. Reciprocal Lattice. . Types of Bonds. Ionic Bond. Covalent Bond. Van der Waals Bond. Diffraction of X-rays by Crystals. Bragg's Law. Powder diffraction patterns Determination of crystallinity in textile fibres- Principle of rotating crystal method. Structure-function relationships (7)

PHYSICAL PROPERTIES OF TEXTILE MATERIALS: Physical properties, chemical composition and molecular arrangement of textile fabrics. Absorbant and repellent textiles. Properties and applications. Static electricity and textiles for anti-static applications (5)

MECHANICAL PROPERTIES AND VISOELASTIC BEHAVIOUR OF MATERIALS : Concepts of stress and strain, Hooke's law, three moduli of elasticity and relation among them, Poison's ratio, bending of beams, bending moment, theory of thin cantilever,determination of young's modulus by cantilever method, twisting of a cylinder, determination of rigidity modulus by torsional pendulum. Elastic and plastic deformation. (6)

TEXTILE MATERIALS FOR INDUSTRIAL APPLICATIONS: Sabine's formula for reverberation time. Reverberation time and auditory comfort. Absorption coefficient, Open Window Units. measurement of absorption coefficients- Impedance tube method, Anechoic chamber method. Materials for modifying surface absorption. Effect of porosity and sound energy dissipation (6)

SMART TEXTILE AND ADVANCED MATERIALS: Definition - function of matrix and reinforcement in composites - classification of composites based on reinforcement-types of composite materials - . Law of mixtures. Applications Dielectric and semiconducting properties of fibres. smart textiles. Bio- mimetic materials. Nanomaterials. (6)

Total L: 30

TEXT BOOKS:

1. William D Callister Jr "Materials Science and Engineering - An Introduction", John Wiley and Sons Inc , New York., 2007
2. Raghavan "Materials Science and Engineering", Prentice Hall of India,New Delhi., 2005.

REFERENCES:

1. Morton W E Hearle, J W S "Physical Properties Of Textile Fibres", CRC Press, Taylor & Francis, USA,., 2008
2. D.S.Kumar "Mechanical Measurements and Control", S.Chand &Co, New Delhi., 1991
3. Holman J P "Experimental Methods of Engineering", McGraw Hill, New Delhi., 2001
4. Gaur R K, Gupta S L "Engineering Physics", Dhanpat Rai publications., 2013

19IT 203 POLYMER AND FIBRE CHEMISTRY

3 0 0 3

INTRODUCTION TO POLYMERS : Classification, functionality of monomers, degree of polymerization, mechanism of polymerization – chain, condensation and ring opening. Molecular weight of polymers – polydispersity, number average and weight average molecular weights. Molecular weight distribution. Determination of molecular weight by gel permeation chromatography and viscometry. (9)

POLYMERISATION METHODS : Addition polymerisation -bulk, solution, suspension and emulsion techniques. Condensation polymerisation -melt, solution and interfacial techniques. Compounding of polymers, Processing techniques - calendaring,compression, injection,extrusion, blow moulding, foaming, fibre spinning-melt, dry and wet spinning. (9)

PROPERTIES OF POLYMER : Amorphous and crystalline states–degree of crystallinity –factors affecting crystallizability. Influence of chemical structure on properties – electrical, solubility, mechanical, thermal - Glass transition temperature – factors affecting Tg, determination of Tg by DSC and thermal stability by TGA, Requisite for polymers to form fibres, elastomers and plastics. Polymer reactions -hydrolysis, acidolysis, aminolysis, hydrogenation. cyclization, crosslinking, grafting. Degradations – chemical, thermal, mechanical and photo degradations. (9)

NATURAL AND REGENERATED FIBRES: Chemical composition, structure and properties of cotton, jute, silk and wool. Regenerated Fibres - principle steps involved –polymer solution preparation. processing –regeneration, concept of reuse of chemicals. Manufacture of viscose rayon, cellulose acetate and lyocell fibres. (9)

SYNTHETIC POLYMERS : PET, nylon 6, nylon 66, acrylic, polypropylene, polyethylene. Structure dependant properties of these fibres. High Performance Fibres- Aramids, UHMWPE, segmented polyurethane and carbon fibres. (9)

Total L: 45

TEXT BOOKS:

1. Gowarikar V. R, Viswanathan N. V, Jayadev Sreedhar "Polymer Science", New Age International (P) Ltd., New Delhi, 2011. , 3rd ed
2. Mishra S.P "A Textbook of Fibre Science and Technology", New Age International (P) Ltd., New Delhi, 2005. , 1st ed

REFERENCES:

1. Joel R. Fried "Polymer Science and Technology", Prentice Hall of India Pvt. Ltd., India, 2003. , 1st ed
2. J. M. G. Cowie, Valeria Arrighi "" Polymers: Chemistry and Physics of modern Materials", CRC Press., USA, 2007. , 1st ed
3. Robert R Mather, Roger H. Wardman "The Chemistry of Textile Fibres", RSC., UK, 2015. , 2nd ed

19IT 204 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

3 0 0 3

ELECTRIC CIRCUITS: Ohm's law, Kirchhoff's Laws, solving simple DC Circuits-single phase AC circuit fundamentals-Power, Power factor-solving simple AC circuits- Introduction to three-phase AC circuits (8)

ELECTRICAL MACHINES: DC MOTORS: Principle of Operation-types-torque equation - speed-torque characteristics-losses and efficiency- speed control of DC motors-Electric Braking AC MACHINES: Single phase Transformers - Construction and working principle, 3 phase Induction Motor-construction–Principle of operation- types-torque equation-speed -torque characteristics-1 phase Induction Motor-Principle of operation-types –Industrial Applications. (12)

ELECTRONIC DEVICES : Operation of PN junction diodes, VI characteristics, zener diode, BJT, types-CB, CE, CC configurations, input and output characteristics, JFET - working principle and characteristics - Comparison of BJT and FET. MOSFET-types, principle of operation and characteristics, Opto Electronic Devices - Introduction, types, photo conductive cells, photo diode, phototransistor, Light emitting diode-Principles and Applications. (8)

ELECTRONIC CIRCUITS : (Qualitative analysis only) Half wave and full wave rectifier, capacitive filters, zener voltage regulator, RC- coupled amplifier, frequency response, RC phase shift oscillator. LINEAR INTEGRATED CIRCUITS: Operational amplifier, Ideal op-amp characteristics, Inverting and Non-inverting amplifier, Op-amp applications :Adder- Subtractor, integrator, differentiator, zero crossing detector. (10)

DIGITAL ELECTRONICS : Number systems-representation of signed numbers: 1's complement and 2's complement, logic gates, Half, full adder/subtractor, Flip flops, RS,JK,JK Master slave, D and T type, counters andshift registers. (7)

Total L: 45

TEXT BOOKS:

1. Mehta V K and Rohit Mehta "Principles of Electrical Engineering and Electronics", S.Chand and Co.., New Delhi, 2014 , 3rd edition
2. 2. Muthusubramanian R, and Salivahanan S "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill., 2012

REFERENCES:

1. Bhattacharya S K "Basic Electrical and Electronics Engineering", Pearson., 2012
2. Rajput R K "Basic Electrical and Electronics Engineering", University Science Press., 2012 , 2nd Edition
3. Gupta B R and Singhal Vandana "Electrical and Electronics Engineering", S. Chand and Co., 2010
4. Theraja B L "Fundamentals of Electrical and Electronics Engineering", S. Chand and Co., 2006

19IT 205 APPLIED MECHANICS

2 1 0 3

STATICS OF PARTICLES AND RIGID BODIES IN TWO DIMENSIONS : Forces – systems of forces - concurrent forces in plane - resultant - problems involving the equilibrium of a particle. Rigid bodies - two dimensional structure - moment of force about an axis - moment of a couple - equivalent systems of coplanar forces - rigid body in equilibrium - problems - types of supports - reactions of beams. (8 + 3)

CENTROID AND MOMENT OF INERTIA : Centroids of areas, composite areas, determination of moment of inertia of plane figures, polar moment of inertia - radius of gyration. (5 + 3)

AXIAL STRESSES AND STRAINS : Stress and strain due to axial force - elastic limit - Hooke's law - factor of safety-stepped bars - stresses in composite bar due to axial force (5 + 3)

SHEAR FORCE & BENDING MOMENT DIAGRAMS : Bending moment and shear force diagrams in simply supported, overhanging and cantilever beams subjected to concentrated loads and UDL. Flexure equation - section modulus - normal stresses due to flexure. (7 + 3)

TORSION : Concept of torsion and torsional shear stress – torsion formula - design of circular shaft – Power transmitted by a shaft. (5 + 3)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Rajasekaran S, Sankarasubramanian G "Engineering Mechanics - Statics and Dynamics", Vikas Publishing House Pvt. Ltd.,., New Delhi, 2011
2. Punmia B C, Jain A K "Strength of Materials and Theory of Structures" Vol.1", Laxmi Publications., New Delhi, 2006

REFERENCES:

1. Beer F P, Johnson E R "Vector Mechanics for Engineers, Statics & Dynamics", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2011
2. Bhavikatti S S "A Text book of Engineering Mechanics", New Age International (P) Ltd., New Delhi, 2012
3. Hibbeler R C "Mechanics of Materials", Pearson Education., New Delhi, 2005
4. Beer F P, Johnson E R "Mechanics of Materials", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2010

19IT 211 ENGINEERING GRAPHICS

0 0 4 2

INTRODUCTION :

1) Lettering practice
2) Geometric constructions
3) Dimensioning practice (as per BIS) (12)

THEORY OF PROJECTION :

1) Projection of points and lines
2) Projection of planes
3) Projection of solids

(12)

SECTIONS OF SOLIDS :

1) Sections of regular solids as per BIS conventions
2) Types of sections - sectional views of simple engineering components
3) Constructing sectional views

(12)

DEVELOPMENT OF SURFACES :

1) Development of lateral surfaces of regular solids
2) Projection of truncated solids and simple engineering sheet metal components

(12)

ORTHOGRAPHIC PROJECTIONS :

1) Orthographic projection of simple engineering components – missing view exercises
2) Orthographic projections of textile machinery parts
3) Modeling of simple engineering components using CAD software

(12)

Total P: 60

TEXT BOOKS:

1. Venugopal K, Prabhu Raja V "Engineering Graphics", New Age International Publishers., New Delhi, 2018 , Fifteenth Multi color edition
2. P.I Varghese "Engineering Graphics", McGraw Hill Education India Pvt. Ltd., New Delhi, 2013

REFERENCES:

1. K C John "Engineering Graphics for Degree", PHI Publishers India Pvt. Ltd., 2009
2. Natarajan K. V "Engineering Drawing and Graphics", M/s Dhanalakshmi N., Chennai, 2007

19IT 212 FIBRE ANALYSIS LABORATORY

0 0 2 1

1) Identification of fibres by microscopic view
2) Identification of fibres by burning behavior
3) Identification of fibres by solubility
4) Fibre Blend Analysis
5) Determination of density of various fibres by density gradient column
6) Determination of denier of synthetic fibres by gravimetric method
7) Determination of Moisture Regain and Moisture content of fibres
8) Analysis of UDY, POY, FDY
9) Study on wet spinning of fibres
10) Degradation study of fibres
11) Prediction of Fibres by Feel and Confirmation Test
12) Demonstration of TGA, DSC, XRD, FTIR techniques and analysis of graphs

(30)

Total P: 30

SEMSTER – 3

19IT 301 NUMERICAL METHODS

2 1 0 3

SYSTEM OF LINEAR EQUATIONS, EIGENVALUES AND EIGENVECTORS: Errors - approximations and round-off errors - truncation errors. system of linear equations, Gauss elimination method, Crout‟s method, Gauss – Seidel method, eigenvalues and eigenvectors - power method.

(6 + 3)

NONLINEAR EQUATIONS: False- position method, Newton-Raphson method, Graeffe‟s root squaring method.

(6 + 3)

INTERPOLATION AND CURVE FITTING: Newton‟s forward and backward interpolating polynomials, Newton‟s divideddifference interpolating polynomials, Lagrange interpolating polynomials. Straight line fitting using least squares method.

(6 + 3)

DIFFERENTIATION AND INTEGRATION: Numerical differentiation - equally spaced and unequally spaced data. Numerical integration - Newton-Cotes formulae, Trapezoidal rule, Simpson‟s 1/3 rule. Gaussian quadratures. (6 + 3)

NUMERICAL SOLUTION TO ORDINARY DIFFERENTIAL EQUATIONS: Taylor-series method, Euler method, modified Euler method, 4th order Runge-Kutta method, multi-step method – Milne‟s method.

(6 + 3)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Steven C Chapra and Raymond P Canale , "Numerical Methods for Engineers", Tata McGraw Hill, New Delhi,
2017.
2. Curtis F Gerald and Patrick O Wheatly , "Applied Numerical Analysis", Pearson, New Delhi, 2017.

REFERENCES:

1. Richard L Burden and Douglas J Faires , "Numerical Analysis", Thomas Learning, New York, 2017.
2. G. Miller , "Numerical Analysis for Engineers and Scientists", Cambridge University Press, UK, 2014.
3. Amos Gilat and Vish Subramaniam , "Numerical Methods for Engineers and Scientists", Wiley India, New Delhi, 2014.
4. Uri M Ascher and Chen Greif , "A first course in numerical methods", Prentice Hall,, New Delhi, 2013.

19T302 THEORY OF MACHINES

3 1 0 4

BASICS OF MECHANISMS AND ITS KINEMATICS : Definitions and basic concepts of link, pair, chain, mechanism, Machine and structure – degrees of freedom, inversions, applications of mechanisms, Velocity and acceleration analysis for four bar and slider crank mechanisms, KLEIN‟S constructions for single slider crank mechanism.

(9 + 3)

FRICTION: Pivot and collar friction – Uniform pressure, wear assumptions, torque power loss. Theory of lubrication Types of bearings and selection of bearings.

(8 + 3)

STATIC AND DYNAMIC FORCE ANALYSIS: Static force analysis in simple mechanisms. Inertia force and D"Alemberts principle, Dynamic force analysis and determination of torque in four bar and single slider crank mechanisms using graphical approach, Calculation of torque required at crank shaft in a loom. (10 + 3)

FLYWHEEL: Torque Vs crank angle diagram – excess energy to be stored in a fly wheel, fluctuation of speed within a cycle. Co-efficient of fluctuations of speed, flywheel weight required for a loom.

(9 + 3)

BALANCING : Principle of balancing – balancing of rotating and reciprocating masses in the same plane and several planes, dynamic balancing of carding cylinder, spindles, tin roller and split pulleys. Vibration: Basics of vibration – measurements, reduction techniques.

(9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Shigley J. E. , Uicker J. J. , "Theory of Machines and Mechanisms", Mc Graw Hill, 2005.
2. Ratan S S , "Theory of Machines", 4 th Edition, Tata McGraw -Hill Publishers, New Delhi, 2017.

REFERENCES:

1. Robert L. Norton , "Kinematics and Dynamics of Machinery (SI Units)", 1 st Edition, Mc Graw Hill Publisher, New Delhi, 2008.
2. David H Myszka , "Machines and Mechanism", 4 th Edition, Pearson Hall PTR, 2011.
3. Thomas Bevan , "Theory of Machines", CBS Publishers, 2000.
4. Kenneth J. Waldron, Gary L. Kinzel, Sunil K. Agrawa , "Kinematics, Dynamics, and Design of Machinery", 3 rd Edition, Wiley, 2016.

19IT 303 MEASUREMENTS AND INSTRUMENTATION

3 0 0 3

INSTRUMENTATION PRINCIPLES: Generalized configuration and functional elements of measuring system - Null and deflection methods-Static characteristics: error, accuracy, precision, resolution, calibration, Hysteresis,modeling and error reduction.

(8)

TRANSDUCERS AND MEASUREMENT OF NON ELECTRICAL VARIABLES: Transducer-Classifications, Principle of operation of Resistance potentiometer, strain gauge, Linear Variable Differential transformer - Inductive Transducer – Capacitance and Piezo-electric transducers, Measurement of thickness, temperature measurement using resistance thermometers, thermocouples and thermistors.

(10)

ELECTRONIC AND TEXTILE INSTRUMENTS: Digital voltmeter-Digital multimeter- Digital storage oscilloscope. Digital data acquisition systems - Magnetic tape recorders, High volume fibre tester-Evenness tester - Single yarn strength tester,hairiness meter.

(10)

CONTROL SYSTEM COMPONENTS: Basics of control system – Control system examples - Principle of operation of Stepper motors - Hydraulic valves - Pneumatic switches, proximity switches and flapper valves - Hydraulic and Pneumatic automation in textile machines.

(9)

PROGRAMMABLE LOGIC CONTROLLERS (PLC): Block diagram – programming methods – programs – applications - material handling system. Data acquisition system for spinning preparatory, ring spinning - weaving. (8)

Total L: 45

TEXT BOOKS:

1. Sawhney A K , "A course in Electrical and Electronics Measurements and Instrumentation", Dhanpat Rai and Sons, New Delhi, 2015.
2. Doebelin E O , "Measurement System : Application and Design", Mc.Graw Hill, New York, 2017.

REFERENCES:

1. Rangan C S, Sharma G R, Mani V S , "Instrumentation Devices and Systems", Tata McGraw Hill, New Delhi, 2001.
2. U.A.Bakshi S.C.Goyal , "Principle of control systems", 7 th Edition, Technical Publication, Pune, 2008.
3. Frank D.petruzella , "Programmable Logic Controllers", 4 th Edition, McGraw-Hill, New York, 2011.
4. Berkstresser G A. Grady P and Buchanan.D R , "Automation in the Textile Industry from Fibres to Apparel", Textile Institute, Manchester, 1995.

19IT 304 FIBRE PHYSICS

3 0 0 3

FIBRE STRUCTURE : Requirements of fibre forming polymers, Analysis of fibre structure models – fringed micelle, fringed fibrillar and lamellar. Characterization of fibres structure. Crystallinity and orientation . Morphological and chemical structure - Cotton, wool, silk, viscose rayon, acetate rayon, polyamides (nylon 6, nylon 6 6), polyester, acrylic fibres. Elucidation of fibre structure. (8)

MOISTURE PROPERTIES: Humidity, moisture regain and content. Equilibrium absorption of moisture-Hygroscopic nature and moisture absorption behavior of textile fibres. Effect of temperature, hydrophilic groups, crystalline and noncrystalline regions on moisture regain. Heats of sorption. - integral and differential.Conditioning of Fibres. (8)

THERMAL PROPERTIES AND THERMO-MECHANICAL RESPONSES: Theories of thermoplastic and non- thermoplastic fibres, First order transition, second-order transition, Specific heat - thermal conductivity. Analysis of DSC and TGA. Heat-setting of fibres. (8)

OPTICAL AND ELECTRICAL PROPERTIES: Refractive index and birefringence - absorption, dichroism, reflection and lustre of fibres. Electrical Properties: Factors influencing electrical properties of fibres , applications. Static Electricity Problems and elimination in textile processes. (8)

MECHANICAL PROPERTIES : Tensile strength, Load-Elongation and Stress-Strain Curves. Modulus, Elongation, Elastic Recovery, Work of Rupture, Work Factor. Effect of parameters on mechanical properties, Mechanical conditioning, Torsional and flexural rigidity of fibres. Creep and stress relaxation. Frictional Properties: General theory and its applications to fibres, Directional Frictional Effect (DFE) of wool. (13)

Total L: 45

TEXT BOOKS:

1. Morton W E., and Hearle J W S. , "Physical Properties of Textile Fibres", 4 th Edition, Wood head Publishing Limited, Manchester, UK, 2008.
2. Gupta V.B and Kothari, V.K , "Manufactured Fibre Technology", Springer science, Netherlands, 1997.

REFERENCES:

1. Marcel Dekar.H B. , "Handbook of Fibre Science & Technology", Textile Institute, Manchester, UK, 1998.
2. Mukhopadhyay , "Advances in Fibre Science", Textile Institute, Manchester, UK, 2000.

19IT 305 SPUN YARN TECHNOLOGY I

3 0 0 3

GINNING AND BLOWROOM : Classification of spinning –short and long staple. Objectives, Machines, ginning defects. Fibre characteristics for yarn production. Blowroom-Objectives, Principles of opening, cleaning, mixing and blending of fibres. Blow room machinery and operating elements. Influence of process parameters on opening and cleaning. Automatic Waste Evacuation systems (AWES), auxillary blow room machines. Effectiveness of opening and cleaning systems. Automation and recent development. Calculations.

(9)

CARDING : Principles of carding. revolving flat card, roller and clearer card, card clothing. Machine elements and operations in card. Sliver formation, carding theory. Automation and recent developments. Calculations.

(9)

DRAWFRAME : Objectives, principles and methods of roller drafting. Machine elements and operations. Autolevellers. Automation and recent developments. Calculations.

(9)

COMBER : Preparation for combing, lap formers. Comber - Objectives, Machine elements and operations, Factors influencing noil extraction. Automation and recent developments. Calculations.

(9)

SPEEDFRAME : Objectives, Machine elements and operations, principle and mechanism of builder motion in speed frame. Automation and recent developments. Calculations.

(9)

Total L: 45

TEXT BOOKS:

1. Werner Klein , "The Rieter Manual of Spinning, Volume.2 – Bloow room& Carding", Rieter Machine Works Limited, Switzerland, 2008.
2. Werner Klein , "The Rieter Manual of Spinning, Volume.3 – Spinning Preparation", Rieter Machine Works Limited, Switzerland, 2008.

REFERENCES:

1. Werner Klein , "The Rieter Manual of Spinning, Volume.1 – Technology of Short staple Spinning", Rieter Machine Works Limited, Switzerland, 2008.
2. Lawrence C.A , "Fundamental of spun yarn technology", CRC Press, New York, 2002.
3. Oxtoby E , "Spun Yarn Technology", Butterworths, London, 2002.
4. Peter R Lord , "Hand book of Yarn Production Technology Science and economics"", Wood head publishing Ltd, New York, 2003.

19IT 306 ECONOMICS FOR ENGINEERS

3 0 0 3

INTRODUCTION : Definition – Nature and Scope – Central Problems of an Economy – Positive and Normative Economics– Micro Economics and Macro Economics, Significance of Economics, Economic Assumptions.

(9)

THEORY OF CONSUMER BEHAVIOR : Utility – Indifference Curve Analysis - Properties, Consumer"s Budget Line Demand Analysis: Demand Function and Law of Demand, Elasticity of Demand. Demand forecasting using Econometric Techniques. Supply – Factors Affecting Supply, Market Equilibrium Price, Consumer Surplus. (9)

PRODUCTION, COST AND REVENUE : Production Function, Total Product, Average Product and Marginal Product, Returns to Scale. Costs, Nature of Costs, Short-run and Long-run Cost Curves, Revenue concepts. (9)

MARKET STRUCTURE : Types of Markets - Perfect Competition – Characteristics – Imperfect Competition: Monopoly – Monopolistic Competition – Oligopoly and Duopoly - Price Discrimination and Product Differentiation under Different Markets – Price and Output Determination in Short run and Long run and profit maximization. (9)

PERFORMANCE OF AN ECONOMY (MACRO ECONOMICS) : Demand and Supply of Money – Quantity Theory of Money, Banking – Functions of Commercial Banks and Central Bank – Inflation – Causes – Control Measures – National Income – Concepts – Methods of Calculating National Income – Problems in Calculating National Income. (9)

Total L: 45

TEXT BOOKS:

1. Varian H.R. , "Intermediate Microeconomics", East– West Press, New Delhi, 2014.
2. Dewett.K.K, Navalur. M.H. , "Modern Economic Theory", S. Chand, New Delhi, 2015.

REFERENCES:

1. William A, Mc Eachern, Simrit Kaur , "Micro ECON", Cengage Learning, Noida, 2013.
2. William A, Mc Eachern, Indira A. , "Macro ECON", Cengage Learning, Noida, 2014.
3. Deepashree , "Principles of Economics", Ane Books Pvt Ltd, New Delhi, 2010.
4. Dwivedi , "Essentials of Business Economics", Vikas Publishing House Pvt Ltd, New Delhi, 2010.

19IT 310 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

0 0 4 2

1. Verification of Ohm's law and Kirchoff's laws.
2. Mechanical Characteristics of DC Shunt and Compound Motor
3. Load test on Three phase Induction Motor
4. Study of Halfwave and Fullwave rectifiers with and without filters
5. Applications of Operational Amplifier: Adder, Subtractor, Integrator and Differentiator
6. Study of logic gates and implementation of binary adder/subtractor
7. Characteristics of temperature sensors (thermocouple/ thermistor)
8. Study of optoelectronic devices (LDR, photodiode, phototransistor)
9. Study of PLC and Basic programming methods
10. Measurement of linear displacement using LVDT and measurement of strain using strain gauge

Total P: 60

REFERENCE:

1. EEE Department , "Electrical and Electronics Engineering Laboratory Manual", EEE Department, PSGCT, Coimbatore, 2019.

19IT 311 SPUN YARN TECHNOLOGY LABORATORY I

0 0 4 2

1) Determination of Beater speed and understanding the working mechanism of any one cleaning machine.
2) Determination of the intensity of beating of bladed beater and fibre rupture and study their influence on the quality
3) of yarn.
4) Determination of the cleaning efficiency and openness of tufts and study their influence on the quality of yarn.
5) Determination of speed of the various rotating elements and understanding its working mechanism & functions
6) of blending machines
7) Running of carding machine and Determination of speed of the various rotating elements and understanding its
8) functions
9) Analysis of various setting points in carding machine and its effect on sliver quality
10) Measurement of PPSI of different clothing profiles and study on the types of card wire clothing
11) Determination of transfer coefficient and cleaning efficiency of a card and its influence on the production and quality
12) Running of draw frame machine and study on drafting waves.
13) Determination of total draft and its distribution in draw frame drafting system.
14) Determination of CV% of input and output sliver with respect to law of doubling and drafting
15) Carry out the analysis of roller setting, measurement of top roller pressure and roller eccentricity in draw frame

Total P: 60

REFERENCES:

1. Spun Yarn Technology Laboratory Manual prepared by Department of Textile Technology, 2019.

19IT 312 ENVIRONMENTAL SCIENCE

20 0 0

INTRODUCTION TO ENVIRONMENT : Environment - Definition, scope and importance. Types and composition of atmosphere – particles, ions and radicals. Ozone layer- significance, formation and depletion. Ecosystems- Structure and functions, components, energy flow, food chains, food web, Biodiversity-levels, values and threats – India as a mega-diversity nation – hotspots of biodiversity – endangered and endemic species of India – conservation of biodiversity. (6)

ENERGY RESOURCES : Introduction – National and International status- exploitation - sustainable strategies- Fossil fuels classification, composition, physico-chemical characteristics and energy content of coal, petroleum and natural gas; solar energy - introduction, harnessing strategies. Wind energy - availability, wind power plants, wind energy conversion systems, site characteristics, and types of wind turbines. Supporting renewable energy resources - tidal –geothermal - hydroelectric. (6)

ENVIRONMENTAL POLLUTION : Definition – Sources, causes, impacts and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards (h) RF hazards - Role of an individual in prevention of pollution. DISASTER MANAGEMENT: Floods, earthquake, cyclone and landslides – Case studies, consequences and rescue measures (6)

WASTE MANAGEMENT : Wastewater - Characteristics of domestic and industrial wastewater - COD and BOD – Various stages of treatment – primary, secondary, tertiary treatment- Biological and advanced oxidation processes. Solid waste management – Characteristics of municipal solid waste(MSW), biomedical, automobile and e-wastes and their management – landfills, incineration, pyrolysis, gasification and composting. (6)

SOCIAL ISSUES AND THE ENVIRONMENT : Environmentally Sustainable work practices- Rain water harvesting – Role of non-governmental organizations. Human ethics and rights- impact on environment and human health – role of information technology on environment and human kind. Green IT policies, Process of EIA - ISO 14000. Legislation- Environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act.

(6)

Total L: 30

TEXT BOOKS:

1. Gilbert M.Masters , "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi,
2004.
2. De A K , "Environmental Chemistry", New Age International P Ltd, New Delhi, 2006.

REFERENCES:

1. Benny Joseph , "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
2. KoteswaraRao MVR , "Energy Resources: Conventional & Non-Conventional", BSP Publications, New Delhi,
2006.
3. Deswal S and Deswal A , "A Basic Course in Environmental Studies", Dhanpat Rai and Co, New Delhi, 2004.

SEMESTER – 4

19IT 401 PROBABILITY AND STATISTICS

2 1 0 3

PROBABILITY AND DISCRETE RANDOM VARIABLES : Probability, axiomatic approach to probability, Baye's theorem, discrete random variables, probability distributions and probability mass functions, cumulative distribution functions, mean and variance, binomial, Poisson and geometric distributions (6 + 3)

CONTINUOUS RANDOM VARIABLES : Continuous random variables, probability distributions and probability density functions, cumulative distribution functions, mean and variance, uniform, exponential and normal distributions. (6 + 3)

STATISTICAL INFERENCE : Point estimation – interval estimation – testing of hypothesis for means - , large, small sample and matched pairs tests - testing of hypothesis for proportions, chi square test for goodness of fit and independence of attributes. (6 + 3)

VARIANCE TESTS AND ANALYSIS OF VARIANCE : Testing of hypothesis for variances - analysis of variance – completely randomized design, randomized block design. (6 + 3)

TIME SERIES ANALYSIS : Introduction, components of time series, the trend, seasonal variation, cyclical variation, irregular variation. (6 + 3)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Douglas C. Montgomery and George C. Runger , "Applied Statistics and Probability for Engineers", Wiley India, New Delhi, 2018.
2. Richard I Levin and David. S. Rubin , "Statistics for Management", Pearson, New Delhi, 2011.

REFERENCES:

1. Richard A. Johnson , "Miller & Freund"s, Probability and Statistics for Engineers", Prentice Hall, New Delhi, 2017.
2. Jay L. Devore , ", Probability and Statistics for Engineering and the Sciences", Brooks/Cole, USA, 2015.
3. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye , "Probability & Statistics for Engineers & Scientists", Pearson, New Delhi, 2016.
4. Robert V Hogg, Elliot Tanis and Dale Zimmerman , "Probability and Statistical Inference", Pearson Education, USA, 2014.

19IT 402 TECHNOLOGY OF MANUFACTURED FIBERS

2 0 0 2

POLYMER PRODUCTION: Polymer Rheology, PET through TPA and DMT route, Nylon 66 and Nylon 6 - Acrylic – Polypropylene. (5)

MELT SPINNING: Requirements, Force and momentum balance in spinline. Equipments-Melting device, Grid and extruder, Static mixer, Pre-filtration, Manifold, Spin pack, Spinneret, Quenching chamber, Spin finish application, Take-up winding. Stress induced crystallization. (6)

SOLUTION SPINNING: Requirements, Kinetic and thermodynamic effects in solution spinning. Preparation of dope, extrusion and fibre formation. Comparison of wet and dry spinning processes. Dry-jet-wet spinning, Gel spinning. (6)

POST SPINNING OPERATIONS: Drawing, Heat setting, Texturisation, Spin finish applications, Staple fibre line production details.

(5)

MODIFIED SYNTHETIC FIBRES: Differentially dyeable fibres, Antistatic and Flame retardant fibres, Micro and Nanofibres, Bicomponent fibres, Hollow fibres. Quality Control-Molecular weight measurements, Melt Flow Index, Thermal characteristic measurements. Measurement of fine structure, morphology and Fibre Denier and Strength. (8)

Total L: 30

TEXT BOOKS:

1. Gupta V B and Kothari V K , "Manufactured fibre Technology", Chapman & Hall Pubilication, UK, 1997.
2. Mclntyre J E , "Synthetic Fibres", Woodhead Publishing Limited, University of Leeds, UK, 2004.

REFERENCES:

1. Vaidya A A , "Production of Synthetic fibres", Prentice-Hall of India Pvt. Limited, New Delhi, 1988.
2. Mishra S P , "A Text Book of Fibre Science and Technology", New Age International (P) Limited, New Delhi, 2000.
3. Hearle J W S, Hollick L and Wilson D , "Yarn Texturing Technology", Wood head Publishing, India, 2001.

19IT 403 SPUN YARN TECHNOLOGY II

2 1 0 3

RING SPINNING I: Objectives, principle of yarn formation, machine elements and operations in ring spinning. Design aspects of various elements in ring frame. Builder motion.

(7 + 3)

RING SPINNING II: Condensed spinning- Principle, methods of yarn production and comparison of yarn properties with ring spun yarn. Spinning Geometry. Calculations. Automation and developments.

(6 + 3)

OPEN-END SPINNING: Principle - Rotor Spinning –mechanism of yarn formation, raw material selection, design Features of important elements and yarn quality. Automation and developments. Calculations. Friction spinning – mechanism of yarn formation, raw material selection and process parameters. Developments. (7 + 5)

OTHER SPINNING SYSTEMS: Air-jet and vortex spinning: Principle of yarn production, raw material selection, process parameters and yarn properties. Principles of Self twist, Wrap, Core and Twist less spinning. Comparison of yarn structure and yarn properties of different spinning systems.

(5+ 3)

YARN PLYING: Objectives and principles of plying of yarns; methods for plying - ring doubling, two for-one and three for one twisting. Selection of twist level for plying. Calculations. Fancy Yarns- Types and production methods. Applications.

(5 + 1)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Lawrence C.A , "Advances in yarn spinning technology", Woodhead Publishing Limited, U.K, 2010.
2. Herbert Stalder , "The Rieter Manual of Spinning, Vol 4, 5 & 6", Rieter Machine Works Limited, Switzerland, 2014.

REFERENCES:

1. Oxtoby E , "Spun Yarn Technology", Butterworth Publications, London, 1987.
2. Mahendra Gowda R.V , "New Spinning systems", NCUTE, New Delhi, 2004.
3. Lawrence, C.A , "Fundamentals of spun yarn technology", CRC Press, UK, 2003.
4. Peter R. Lord , "Handbook of Yarn Production: Technology, Science and Economics", Wood head Publishing, UK, 2003.

19IT 404 WEAVING TECHNOLOGY I

3 0 0 3

WINDING : Winding - objectives, random and precision winders, elements and functions - unwinding accelerator, tension device, yarn clearer, splicer, waxing, anti-patterning, drum type, link coner, automation. Package types, faults – causes and remedies, Calculations. Winding synthetic and blended yarns, winding for coloration. Pirn winding – objectives, elements and functions

(9)

WARPING, SIZING AND DRAWING-IN : Warping - objectives, direct and section warping, elements and functions – creel, stop motion, tension device, warper reed, automation. Section warping – section building and traverse, leasing. Sizing - objectives, size recipe, elements and functions – creel, sow box, drying zone, yarn splitting, automation. Single end sizing, Calculations. Sizing of filament yarns, energy conservation in sizing. Beam gaiting, tyeing-in.

(9)

PROCESS CONTROL IN WARPING AND SIZING : Controls – temperature, level, moisture, stretch. Size pick up and end breaks. process control in warping and sizing – control of end breaks, hard waste and beam defects, combined dyeing and sizing, dead loss in sizing.

(5)

PRIMARY MOTIONS IN SHUTTLE WEAVING : Loom types, timing diagram. Shedding – tappet, dobby and jacquard. Shed geometry, shed types, reversing motions. Picking – overpick and underpick, shuttle flight and timing, shuttle checking. Beat-up – sley kinematics and eccentricity.

(13)

SECONDARY AND AUXILLARY MOTIONS : Take up, let off, warp stop, weft stop, warp protector, weft feelers and pirn change motions, drop box motion. Production and efficiency calculations.

(9)

Total L: 45

TEXT BOOKS:

1. Talukdar M.K., Sriramulu P.K. and Ajgaonkar D.B , "Weaving: Machines, Mechanisms, Management", Mahajan Publishers, Ahmedabad, 1998.
2. Marks R. and Robinson T.C , "Principles of Weaving", The Textile Institute, Manchester, 1989.

REFERENCES:

1. Lord P.R, and Mohamed M.H , "Weaving: Conversion of Yarn to Fabric", Merrow, New Delhi, 1992.
2. Booth J.E , "Textile Mathematics - Volume 3", The Textile Institute, Manchester, 1977.
3. Mukesh Kumar Singh , "Industrial Practices in Weaving Preparatory", WPI Publishers, UK, 2014.
4. Abhijit Majumdar , "Principles of Woven Fabric Manufacturing", 1 st Edition, CRC Press, 2016.

19IT 405 TECHNOLOGY OF NONWOVEN FABRICS

3 0 0 3

RAW MATERIAL AND WEB FORMATION : Nonwoven process, raw materials – web formation – web bonding. Classification. Raw materials preparation for the production of nonwovens, binders-requirements, properties. Web formation - Classification, Dry lay process, Wet lay method. Extrusion nonwovens - spun bond and meltblown. Web drafting. (9)

WEB BONDING : Mechanical bonding - Needle punching, Stitch bonding, Spun lacing. Chemical bonding. Thermal bonding. Process variables and their effect on nonwoven properties. (9)

FINISHING OF NONWOVENS : Mechanical finishing – shrinking, compacting and creping, calendering, pressing, perforating, slitting, breaking, splitting, suede finishing, shearing, raising, singeing and sewing. Chemical finishing-washing, dyeing, printing, finishing, softening, special effects, coating, laminating, flocking. (9)

TESTING AND CHARACTERISTICS OF NONWOVENS : Testing of raw materials for nonwovens, testing of nonwovens, test processes related to end-use. Identification of nonwovens. Nonwoven fabric structure-property relations of on woven. (9)

APPLICATIONS OF NONWOVENS : Hygiene products, cleaning and household products, home textiles, apparels, technical applications. (9)

Total L: 45

TEXT BOOKS:

1. Wilhelm Albrecht , "Nonwoven Fabrics", Wiley – VCH, Verlag Gmbh and Company, Germany, 2003.
2. Russel.S , "Handbook of Nonwovens", Textile Institute Publication, UK, 2004.

REFERENCES:

1. Krcma R , "Manual of Nonwovens", Textile Trade Press, USA, 1993.
2. Irsak O , "Nonwoven Textiles", Textile Institute,, UK, 1999.
3. Mrstina V and Feigl F , "Needle Punching Technology", Elsevier Science Publishers,, India, 1990.

19IT 406 KNITTING TECHNOLOGY

3 0 0 3

BASICS OF WEFT KNITTING : Comparison of woven, knitted and bonded fabrics. Reasons for the growth of the knitting industry. Uses of weft knitted fabrics. Yarn quality requirements for knitting. Knitting classification- Weft knit and warp knit. General definitions and elements of knitted loop structure. Types of knitting needles- Bearded, Latch and Compound Needle (9)

WEFT KNIT MACHINES AND FABRIC STRUCTURES : Basic weft knitted structures and their production - plain, rib, interlock and purl. Mechanical elements and operations. Fundamentals of formation of knit, tuck and float stitches. Notations. Double knit structures and specialty structures. Flat Knitting: Types, Mechanical elements and operations, Weft knit structures using flat bed. (10)

WEFT KNITTED FABRIC GEOMETRY : Faults in circular knitting, their causes – avoidance. Production calculation in weft knitting, weft knitted fabric geometry: Loop length, stitch density, tightness fabric, areal density and optimum knitting conditions. Advancements in weft knitting: Auto stripper, roving to knitting, jacquard knitting, loop transfer, Racking (8)

WARP KNITTING AND STRUCTURAL ELEMENTS : Basic principles and loop elements- open loop, closed loop. Mechanical elements and operations of Tricot, raschel, simplex and 2 needle bar raschel machines. Knitting cycle, lapping diagrams and notations. Guide bars movement, chain links and threading. Double needle bar patterning. (9)

GEOMETRY AND APPLICATIONS OF WARP KNITTED FABRICS : Specialty structures of warp knitting, Production calculation. Warp knit fabric geometry. Applications of warp knit fabrics: Medical textiles, filtration, protective textiles and other areas of technical textiles.

(9)

Total L: 45

TEXT BOOKS:

1. Spencer D J , "Knitting Technology", Third Edition, Textile Institute Publication, Manchester, 2001.
2. Anbumani N , "Knitting-Fundamentals, Machines, Structures and Developments", New Age International (P) Ltd, New Delhi, 2007.

REFERENCES:

1. Raz E , "Warp Knitting Technology", Coloumbine Press, Buxton, 1992.
2. Brackenbury.T , "Knitted Clothing Technology", Blackwell Science, London, 1992.
3. Wilkens C , "Warp knit machine elements", Blackwell Science, London, 1997.
4. Aigaonkar D B , "Knitting Technology", Universal Publication Corpn, Bombay, 1998.

19IT 410 SPUN YARN TECHNOLOGY LABORATORY II

0 0 4 2

1) Running of comber machine, understanding its working mechanism & functions of different combing elements and determination of draft and production
2) Determination of the Fractionating efficiency of comber and estimation of noil extraction (between head and overall) in a comber machine.
3) Construction details of nipper assembly and detaching roller drives and determination of timings of various components with respect to index wheel.
4) Sample development in speed frame machine, understanding its working mechanism & functions of drafting elements and determination of draft and production
5) Study of flyers in speed frame &speed frame builder motion and determination of false twist, flyer speed & bobbin speed.
6) Study of material flow in ring frame, arrangement of ring frame drafting System & functions of various drafting elements and determination of draft and production and analyze the effect of twist on the yarn strength.
7) Examination of construction and working of a ring frame builder motion and determination of winding: binding coil ratio.
8) Analysis of spinning geometry in existing ring frame and determination of winding angle variation during winding of ring cop.
9) Sample development in rotor spinning machine, understanding its working mechanism & functions of various spinning elements and determination of draft and production
10) Sample development in TFO and Fancy doubler machine, understanding its working mechanism & analysis of TPI and fancy yarn structure.

Total P: 60

REFERENCE:

1. Spun Yarn Technology Laboratory Manual prepared by Department of Textile Technology, 2019.

19IT 411 WEAVING TECHNOLOGY LABORATORY

0 0 4 2

1. Determination of Winding parameters in Random / Precision Winding Machine
2. Determination of Shed Depth in Tappet Shedding Motion
3. Creation of Dobby design and fabric production in Dobby loom
4. Creation of Jacquard design and preparation of Punched Card
5. Determination of Picking angle, Picking Velocity, Picking force and Power in Underpick loom
6. Determination of Sley Eccentricity in shuttle loom
7. Dismantling and assembly of Take-up Motion and calculation of loom dividend
8. Determination of Rate of Let-off at various Beam Diameters in positive and negative let-off systems
9. Study of Weft feelers, Weft and Warp Stop Motions
10. Preparation of Pattern Card in Drop box loom
11. Preparation of Special fabrics in handloom
12. Understanding of Loom requirements from the given Fabric Sample

Total P: 60

REFERENCE:

1. Weaving Technology Laboratory Manual prepared by Department of Textile Technology, 2019. Publishing House, New Delhi, 2011

ELECTRONICS AND COMMUNICATION ENGINEERING

Code No.	Course Title	Periods / week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	FE	Total
SEMESTER I								
19IE 101	Calculus and its Applications	3	1	0	4	50	50	100
19IE 102	Physics	3	0	0	3	50	50	100
19IE 103	Chemistry of Electronic Materials	3	0	0	3	50	50	100
19IE 104	Problem Solving and C Programming	2	0	0	2	50	50	100
19IE 105	English Language Proficiency	2	1	0	3	50	50	100
19IE 110	Engineering Graphics	0	0	4	2	50	50	100
19IE 111	Basic Sciences Laboratory	0	0	4	2	50	50	100
19IE 112	Problem Solving and C Programming Laboratory	0	0	2	1	50	50	100
19IG 065	German Language – A1	12	0	0	4	100	-	100
19IH 071	Indian Language	2	1	0	3	50	50	100
SEMESTER 2								
19IE 201	Complex Variables and Transforms	3	1	0	4	50	50	100
19IE 202	Materials Science	2	0	0	2	50	50	100
19IE 203	Industrial Electrochemistry	2	0	0	2	50	50	100
19IE 204	Electron Devices	3	0	0	3	50	50	100
19IE 205	Circuit Theory	3	1	0	4	50	50	100
19IE 211	Devices and Circuits Laboratory	0	0	4	2	50	50	100
19IE 212	Python Programming Laboratory	0	0	4	2	50	50	100
19IE 214	Professional Skills	6	0	9	2	50	50	100
19IE 215	Internship – Summer Training	6	0	9	2	50	50	100
19IG 066	German Language – A2	12	0	0	4	100	-	100
19IH 072	American History	2	1	0	3	100	-	100
SEMESTER 3								
19IE 301	Linear Algebra and Numerical Analysis	3	1	0	4	50	50	100
19IE 302	Analog Electronics	3	0	0	3	50	50	100
19IE 303	Digital Electronics	3	0	0	3	50	50	100
19IE 304	Electromagnetic Fields and Waves	3	1	0	4	50	50	100
19IE 305	Data Structures and Algorithms	2	2	0	4	50	50	100
19IE 306	Economics for Engineers	3	0	0	3	50	50	100
19IE 310	Analog Electronics Laboratory	0	0	2	1	50	50	100
19IE 311	Digital Electronics Laboratory	0	0	2	1	50	50	100
19IE 312	Environmental Science	2	0	0	0	100	-	100
19IG 067	German Language – B1.1	12	0	0	4	100	-	100
19IH 073	Organization Behavior	3	0	3	3	50	50	100

SEMESTER 4								
19IE 401	Probability and Random Processes	3	1	0	4	50	50	100
19IE 402	Linear Integrated Circuits	3	0	0	3	50	50	100
19IE 403	Signals and Systems	3	0	0	3	50	50	100
19IE 404	Measurements and Instrumentation	2	1	0	3	50	50	100
19IE 405	Computer Architecture	3	1	0	4	50	50	100
19IE 406	Antennas and Wave Propagation	3	1	0	4	50	50	100
19IE 410	Linear Integrated Circuits Laboratory	0	0	2	1	50	50	100
19IE 411	Signals and Systems Laboratory	0	0	2	1	50	50	100
19IG 067	German Language – B1.2	12	0	0	4	100	-	100
19IH 074	TOFEL / IELTS Training	6	0	9	2	50	50	100
SEMESTER 5								
19IE 501	Open Elective I	3	0	0	3	50	50	100
19IE 502	Communication Engineering	3	0	0	3	50	50	100
19IE 503	Microprocessors and Microcontrollers	3	0	0	3	50	50	100
19IE 504	Control Systems	3	0	0	3	50	50	100
19IE 505	Computer Networks	3	1	0	4	50	50	100
19IE 506	Professional Elective I	3	0	0	3	50	50	100
19IE 510	Communication Engineering Laboratory	0	0	2	1	50	50	100
19IE 511	Microprocessors and Microcontrollers Laboratory	0	0	2	1	50	50	100
19IG 069	German Language – B2	12	0	0	4	100	-	100
SEMESTER 6								
19IE 601	Digital Signal Processing	3	0	0	3	50	50	100
19IE 602	Digital Communication	3	0	0	3	50	50	100
19IE 603	VLSI Design	3	0	0	3	50	50	100
19IE 604	Embedded Systems and IoT	3	1	0	4	50	50	100
19IE 605	Digital Image Processing	3	0	0	3	50	50	100
19IE 610	Digital Signal Processing Laboratory	0	0	2	1	50	50	100
19IE 611	VLSI Design Laboratory	0	0	2	1	50	50	100
19IE 620	Innovation Practices	0	0	4	2	100	-	100
19IG 070	German Language	12	0	0	4	100	-	100

DETAILED SYLLABI

SEMESTER - 1

19IE 101 CALCULUS AND ITS APPLICATIONS

3 1 0 4

DIFFERENTIAL CALCULUS: Functions of two variables, limit, continuity, partial derivatives, differentiability, total differential, extreme values and saddle points, constrained maxima and minima, Lagrange multipliers with single constraint, Taylor ‘s formula for two variables. (9 + 3)

MULTIPLE INTEGRALS I: Basic concepts, double integrals over rectangles, double integrals as volumes, Fubini‘s theorem, double integrals over general regions, area by double integration, reversing the order of integration. (9 + 3)

MULTIPLE INTEGRALS II: Double integrals in polar form, triple integrals in rectangular coordinates, spherical and cylindrical coordinates. (9 + 3)

SECOND ORDER LINEAR ORDINARY DIFFERENTIAL EQUATIONS: Homogeneous linear ODEs of second order, linearity principle, general solution, homogeneous linear ODEs with constant coefficients, Euler–Cauchy equations, solution by variation of parameters, modeling of electric circuits. (9 + 3)

VECTOR CALCULUS: Gradient of a scalar field, directional derivative, divergence of a vector field, curl of a vector field. Integration in vector field – line integrals, Green‘s, Gauss divergence and Stokes‘s theorems. (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Joel Hass, Christopher Heil, Maurice D.Weir "'Thomas‘ Calculus", Pearson Education., New Delhi, 2018
2. Erwin Kreyszig "Advanced Engineering Mathematics", Wiley India Pvt Ltd., New Delhi, 2015

REFERENCES:

1. J.E.Marsden, A.J.Tromba, A. Weinstein "Basic multivariable Calculus", Springer Verlag., New York, 2019
2. Howard Anton, Irl Bivens, Stephen Davis "Calculus", John Wiley & Sons, INC., USA, 2016
3. Wylie C R and Barrett L C "Advanced Engineering Mathematics", Tata McGraw-Hill., New Delhi, 2019
4. James Stewart "Multivariable Calculus", Brooks Cole., USA, 2012

19IE 102 PHYSICS

3 0 0 3

OSCILLATORY MOTION: Review of simple harmonic motion - Differential equation of SHM. Velocity and acceleration. Restoring force. Vibration of a spring and mass system. Frequency response, phase response and resonance. Analogy with LCR circuits and oscillators. Energy and energy loss. Damped oscillations. Significance in control systems, vibration and vibration isolation. (9)

WAVE MOTION: Definition of a plane progressive wave. Attenuation of waves. Representation of waves using complex numbers. Differential equation of a plane progressive wave. Phase velocity. Phase and phase difference. Solution of the differential equation of a plane progressive waveform of differential equation of 3-dimensional wave motion (no detailed solution). Introduction to numerical methods for solution of wave equation. Importance of spherical and plane wave fronts. (9)

OPTICS: Review of image formation in lenses and mirrors. Spherical and chromatic aberration. Methods of reducing aberrations (no derivations) - aspherical components, aperture control, multiple elements. Principle of adaptive optics. Role of actuators in adaptive optics. Fresnel mirrors- principle and applications for solar energy. Tracking of Fresnel mirrors. Interference and diffraction: Principle of Fabry-Perot interferometer. Diffraction due to circular apertures. Applications. Spectral distribution: emission, transmission and absorption spectra. Examples. (9)

HEAT : Review of thermal properties, Black body radiation, Specific heat capacity, thermal capacity and coefficient of linear thermal expansion. Methods of measurement of thermal expansion. Thermal stresses in composite structures due to nonhomogeneous thermal expansion. Applications -The bimetallic strip. Differential equation of one-dimensional heat flow. Searle's apparatus and Lee's disc apparatus for determination of thermal conductivity. Thermal Insulation. Convection and radiation. Heat dissipation and heat sinking of electronic devices. (9)

ELECTROMAGNETISM : Review of definitions of fundamental terms. Permeability. Forces due to currents. Uniform and nonuniform magnetic fields. Static and time-varying magnetic fields. Electromagnetic induction. Expression for induced emf. Electric fields definition of fundamental terms. Dielectric constant, Permittivity. Dielectric displacement. Gauss theorem. Electromagnetic waves. Propagation of electromagnetic waves through isotropic media. Maxwell‘s equations and interpretation of Maxwell's equations. (9)

Total L: 45

TEXT BOOKS:

1. Richard Wolfson "Essential University Physics", Pearson Education., 2016 ,3 rd Edition
2. Ghatak A "Optics", Tata McGraw-Hill India., 2017 , 6th Edition

REFERENCES:

1. Avadhanulu M. N "Engineering Physics", S. Chand & Co., 2010
2. Purcell E. M. "Electricity and Magnetism", Tata McGraw-Hill.,2017
3. Paul A. Tipler, Geene Mosca "Physics for Scientists and Engineers", W.H.Freeman and Company., New York, 2007 , 6 th Edition
4. Crawford F. S "Waves", Berkeley Physics Course., 2017 ,1 st Edition

19IE 103 CHEMISTRY OF ELECTRONIC MATERIALS

3 0 0 3

CONDUCTING PROPERTIES OF MATERIALS : Molecular orbital treatment of bonding in metals, insulators, semiconductors – direct band and indirect band, elemental, p-doped, n-doped, stoichiometric compound semiconductors and chalcogen semiconductors. Crystal defects and their influence on properties of materials – intrinsic defects - schottky and frenkel, nonstoichiometeric compounds, extrinsic defects - oxide ion conductors - applications. Nanoscale materials – Quantum dots-band gap – size dependant optical properties.

(9)

POLYMERIC MATERIALS : Classification, degree of polymerization, average molecular weights, polydispersity. Polymerization reactions – chain and condensation. Thermal properties -glass transition temperature(Tg) – factors affecting Tg - determination by DSC. Mechanical properties – significance in fabrication of electronics. Electrical insulating properties - dielectric breakdown - aging of polymer insulations - discharges in voids, electrical treeing. Thermal and photochemical degradations. Additives - plasticisers, stabilisers, functional additives.

(9)

FLEXIBLE ELECTRONIC MATERIALS : Conjugated polymers – electronic energy bands - mechanism of charge transport – intrachain and interchain - solitons, polarons and bipolarons. Factors influencing charge transport – structural features - defects, molecular weight, crystalline/amorphous nature, doping-oxidative and reductive. Synthesis, properties and applications of polyaniline, polythiophene and polypyrrole. Molecular electronics - graphene, fullerenes, carbon nanotubes – structure, synthesis, properties and applications.

(9)

OPTOELECTRONIC MATERIALS : Electroluminescence- exciton, OLED materials– emitters- charge transfer complexes, metal chelates, polycyclic aromatic oligomers, conjugated polymers – polyphenylenes, polyfluorenes. Liquid crystalline polymers- classification of liquid crystals, chemical constitution, stability and applications. Organic and dye sensitized photovoltaics – working principle, materials, advantages and disadvantages. Preparation of ultrathin polymer films - Langmuir-Blodgett Films –self assembled monolayers. (9)

MATERIALS FOR ELECTRONICS PROCESSING : Semiconductor wafer fabrication -Overview and challenges –high purity chemicals, air filters for clean rooms, electronic grade water- quality parameters, water treatment stages for ultrapure water production – membranes and ion-exchange resins, electrodialysis. Photoresists for wafer fabrication – microlithography, resist requirements, material chemistry. Electronic packaging materials-adhesives, connectors, eutectic alloys, phase change materials-phase diagrams, applications.

(9)

Total L: 45

TEXT BOOKS:

1. Lesley E.Smart, Elaine A.Moore "Solid State Chemistry - an Introduction", CRC Press., London, 2005. , 4th edition.
2. Cowie J.M.G, Valeria Arrighi "Polymers: Chemistry and Physics of modern materials", CRC Press., London, 2007. , 3rd edition.

REFERENCES:

1. Sam-Shajing Sun, Larry R. Dalton "Introduction to Organic Electronic and Optoelectronic Materials and Devices", CRC press., London, 2017. , 2nd edition
2. Stergios Logothetidis "Handbook of Flexible Organic Electronics Materials - Manufacturing and Applications", WoodHead publishing., London, 2015. , 1st edition
3. Peter Van Zant "Microchip Fabrication: A Practical Guide to Semiconductor Processing", Mc Graw Hill,., 2014. , 6th edition
4. Anthony R.West "Solid state chemistry and its applications", John Wiley., USA, 2014. , 2nd edition

19IE 104 PROBLEM SOLVING AND C PROGRAMMING

2 0 0 2

INTRODUCTION TO PROBLEM SOLVING : Analyzing and Defining the Problem - Algorithm - Flow Chart – Program development steps -Types of programming language. C: The C character set - Identifiers and keywords – Data types – Constants - Variables - Declarations -input and output functions-preprocessor directives. (3)

OPERATORS AND EXPRESSIONS : Arithmetic operators - Unary operators - Relational operators - logical operators - Assignment operators - Conditional operators - comma operator - sizeof operator - precedence and associativity - Library functions. CONTROL STATEMENTS: simple if, if..else, nested if .. else ,elseifladder , switch case - while -do while - for - Nested loops - break – continue – goto statements.

(9)

ARRAYS : Defining an array - Processing an array - Multi dimensional arrays -strings. (6)

FUNCTIONS : Function prototype - Defining a function – function call - Passing arguments to a function – nested function – recursive function- Storage classes - auto - static - extern and register variables (4)

STRUCTURES : Definitions - Processing a structure – Array and structures – Nested structures - Structures and functions. POINTERS: Definition - Pointer Arithmetic – types of pointer - const pointer, pointer to a constant, void pointer, null pointer (8)

Total L: 30

TEXT BOOKS:

1. Deitel H. M. and Deitel P. J "C: How To Program", Prentice Hall of India., New Delhi, 2015
2. Ajay Mittal "Programming in C - A Practical approach", Pearson., New Delhi, 2010

REFERENCES:

1. Gottfried B "Programming with C", McGraw Hill Education., New Delhi, 2018
2. Herbert Schildt "C: The Complete Reference", McGraw Hill., New Delhi, 2017
3. Kernighan B. W. and Ritchie D. M "Programming Language (ANSI C)", Prentice Hall of India., New Delhi, 2013

19IE 105 ENGLISH LANGUAGE PROFICIENCY

2 1 0 3

LEARNING LANGUAGE THROUGH STANDARD LITERARY AND GENERAL TEXTS : Integrated Tasks focusing on Language Skills - Training based on Text based Vocabulary, tone, register and Syntax features (12 + 0)

GRAMMAR IN CONTEXT : Word Order - Subject Verb Concord - Style features - Tenses, Conditionals, Prepositions, Active and Passive Voice, Modals, Cloze and Spotting Errors exercise (10 + 0)

GUIDELINES FOR WRITTEN COMMUNICATION : Principles of Clear Writing - Paragraph Writing - Essay Writing - Emphasis Techniques - Summarizing and Paraphrasing - Analytical Writing (8 + 0)

FOCUS ON SPOKEN ENGLISH : Task – based activities with graded levels of difficulty and with focus on language functions - Level 1: Self – expression – Greetings in Conversation, Hobbies, Special interests, Daily routine - Level 2: General Awareness – Expression of Concepts, Opinions, Social Issues, Description of a process / picture/chart, news presentation / review - Level 3: Advanced Skills – Making Short Speeches and Participating in Role Plays (0 + 10)

LISTENING ACTIVITY : Task based Activities using Language Laboratory (0 + 5)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Faculty - Department of English "Course materials on English language proficiency", PSG College of Technology., Coimbatore, 2019

REFERENCES:

1. Jill Singleton "Writers at Work: The Paragraph", Cambridge University Press., New York, 2012
2. Simon Haines, Mark Nettle and Martin Hewings "Advanced Grammar In Use", Cambridge University Press., New Delhi, 2008
3. Anne Laws "Writing Skills", Orient Black Swan., Hyderabad, 2011
4. Sinha DK "Specimens of English Prose", Orient Black Swan., Hyderabad, 2012

19IE 110 ENGINEERING GRAPHICS

0 0 4 2

INTRODUCTION

1) Lettering practice
2) Geometric constructions
3) Dimensioning practice as per BIS conventions

THEORY OF PROJECTION (12)

1) Projection of points and lines
2) Projection of planes
3) Projection of solids

SECTIONS OF SOLIDS

1) Sections of regular solids as per BIS conventions
2) Types of sections - sectional views of engineering components
3) Constructing sectional views (12)

DEVELOPMENT OF SURFACES

1) Development of lateral surfaces of regular solids
2) Projection of truncated solids and simple engineering sheet metal components (12)

ORTHOGRAPHIC PROJECTION

1) Projection of simple engineering components and missing view exercises
2) Modeling of simple engineering components using CAD software (12)

Total P: 60

TEXT BOOKS:

1. Venugopal K, Prabhu Raja V "Engineering Graphics", New Age International Publishers., New Delhi, 2018 , 15th Multi color edition.
2. P.I Varghese "Engineering Graphics", McGraw Hill Education India Pvt. Ltd., New Delhi, 2013

REFERENCES:

1. K C John "Engineering Graphics for Degree", PHI learning private limited, 2009
2. Bureau of Indian Standards "Engineering Drawing Practices for Schools and Colleges SP 46-2003", BIS., New Delhi, 200

19IE 111 BASIC SCIENCES LABORATORY

0 0 4 2

PHYSICS LABORATORY (ANY EIGHT EXPERIMENTS) :

1. Determination of thermal conductivity of bad conductor using Lee‘s Discmethod
2. Determination of fibre thickness – air wedge method
3. Determination of wavelength of mercury spectrum using transmission grating
4. Measurement of vibration frequency of electrically maintained tuning fork usingMelde‘s apparatus
5. Determination of velocityof sound – Helmholtz resonator 27
6. Determination of Hysteresis loss of a ferromagnetic material
7. Determination of Temperature Coefficient of Resistance of metallic wire using post office box
8. Determination of capacitance using LCR bridge
9. Study of reverse bias characteristics of Germanium diode and determination of its bandgap
10. Thermistor: Measurement of temperature and bandgap

(30)

CHEMISTRY (ANY EIGHT EXPERIMENTS) :

1. Determination of hardness,TDS, pH and conductivity of a water sample.
2. Determination of molecular weight of polymers by Ostwald / Ubbelohde Viscometer.
3. Construction of phase diagram for eutectic system – for application in electronic cooling system.
4. Study of a galvaniccell.
5. Conductometric estimation of acid strength of a pickling bath.
6. Potentiometric estimation of ferrous ion in an effluent.
7. Anodizing of aluminium and determination of thickness of anodised film.
8. Preparation of chloride ion sensor by anodizing silverand calibration.
9. Electroplating of nickel & copper and determination of cathode efficiency.
10. Examination of different forms of corrosion using Ferroxyl indicator and determination of corrosion rate by current measurement. (30)

Total P: 60

REFERENCES:

1. Department of Chemistry "Basic Science Laboratory Manual", 2019
2. Department of Physics "Physics Practicals", 2019
3. Wilson J. D. and Hernandez C. A. "Physics Laboratory Experiments", Houghton Miffin Company, New York., 2009

19IE 112 PROBLEM SOLVING AND C PROGRAMMING LABORATORY

0 0 2 1

1. Working with RAPTOR Tool – Flowchart Interpreter
2. Operators
3. Decision making Statements
4. Loops : while , do..while, for
5. One dimensional array
6. Two dimensional array
7. Strings
8. Functions
9. Recursive functions
10. Structures
11. Structures and arrays
12. Nested Structures
13. Pointers

(30)

Total P: 30

REFERENCES:

1. Deitel H. M. and Deitel P "C: How To Program", Prentice Hall of India., New Delhi,2015
2. Ajay Mittal "Programming in C - APractical approach", Pearson., New Delhi, 2010
3. Gottfried B "Programming with C", McGraw Hill Education., New Delhi, 2018
4. Herbert Schildt "C: The Complete Reference", McGraw Hill., New Delhi, 2017

SEMESTER - 2

19IE 201 COMPLEX VARIABLES AND TRANSFORMS

3 1 0 4

COMPLEX DIFFERENTIATION : Complex differentiation - analytic function, Cauchy - Riemann equations, harmonic functions, linear fractional transformations. (9 + 3)

COMPLEX INTEGRATION : Cauchy's integral theorem, Cauchy's integral formula, Laurent series, singularities and zeros, residue integration method (Residue integration of complex integrals only). (9 + 3)

LAPLACE TRANSFORMS : Laplace transform, inverse transform, linearity, s-shifting, transforms of derivatives and integrals, unit step function, t - shifting, Dirac's delta function, periodic functions, method of solving differential equations by using Laplace transform technique. (9 + 3)

FOURIER SERIES : Fourier series- convergence and sum of Fourier series, functions of any period 2L, even and odd functions, half range expansions. (9 + 3)

FOURIER TRANSFORMS : Fourier transform, Fourier cosine and sine transforms - Discrete Fourier transform – Fast Fourier transform – DIT algorithm. (9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Erwin Kreyszig "Advanced Engineering Mathematics", John Wiley & Sons., New Delhi, 2015
2. Wylie C. R. and Barrett L. C "Advanced Engineering Mathematics", Tata McGraw-Hill., New Delhi, 2019

REFERENCES:

1. Mathews J. H. and Howell R. W "Complex Analysis for Mathematics and Engineering", Narosa Publishing House., New Delhi, 2012
2. Peter V.O Neil "Advanced Engineering Mathematics", Cengage., New Delhi, 2016
3. Dennis G Zill "Advanced Engineering Mathematics", Jones & Bartlett India P Ltd., New Delhi, 2017
4. Dean G Duffy "Advanced Engineering Mathematics with MATLAB", CRC., USA, 2017

19IE 202 MATERIALS SCIENCE

2 0 0 2

QUANTUM MECHANICS : Wave particle duality, de Broglie waves- Heisenberg's uncertainty principle. Wave functionnormalization. The wave equation. Schrodinger's equation of motion: Time dependent form, steady-state form. Particle in a box. Quantum Tunneling and applications to Scanning Tunneling Microscope and Tunnel diode. (8)

ELECTRICAL PROPERTIES : Conducting materials-quantum free electron theory -Fermi Dirac Statistics-Band theory of solids-the density of states. Dielectrics-types of polarization-measurement of dielectric permittivity-Loss factor-Dielectric loss mechanisms. Magnetostriction. Electron ballistics- materials for thermionic (7)

PHYSICS OF SEMICONDUCTORS : P type and N type semiconductors-the effective mass. Free electron and hole concentration in semiconductors. Band gap determination. Carrier concentration in n and p type semiconductor. P- N junction, rectifier equation - Hall effect-Quantum tunneling. Hetero junction-Quantum well, wire, dots - Optical properties of Semiconductors: LD, LED, Photo diode. Introduction to MEMS (8)

MAGNETIC PROPERTIES : Types of magnetic materials-domain theory – hysteresis - hard and soft magnetic materials – Applications - eddy current brakes, regenerative braking. Magnetic lenses. Superconductivity – Meissners effect - Josephson junction, SQUID magnetometer, applications. (7)

Total L: 30

TEXT BOOKS:

1. William D Callister Jr "Materials Science and Engineering - An Introduction", John Wiley and Sons Inc., New york, 2007 , 6 th edition
2. Arthur Beiser "Concepts of Modern Physics", Tata Mcgraw Hill., India, 2002

REFERENCES:

1. James F Shackelford S "Introduction to Materials Science for Engineers", Macmillan Publishing Company., India, 1992, 3rd edition
2. Van Vleck "Elements of Material Science and Engineering", Pearson Education., India, 2008
3. Sze S.M "Physics of Semiconductor Devices", John Wiley and Sons., USA, 2007
4. Donald R Askeland, Wendelin J Wright "Essentials of Materials Science and Engineering",Cengage Learning., USA, 2013 , 3rd edition

19IE 203 INDUSTRIAL ELECTROCHEMISTRY

2 0 0 2

ELECTROCHEMISTRY : Conductance of strong and weak electrolytes, mobility of ions - transport number, applications of conductance measurement. Electrode potential – standard and reference electrodes, Nernst equation, emf series – applications. Galvanic and concentration cells. Applications of emf measurements – glass electrode - pH measurement, potentiometric - redox titrations. (6)

CORROSION : Mechanisms - Galvanic and differential aeration corrosion. Corrosion rate – factors influencing corrosion - Galvanic series. Corrosion control - corrosion inhibitors, cathodic protection - sacrificial anode, current impression, conversion coatings – anodizing – determination of thickness of anodized film. Nature inspired coatings - superhydrophobic coatings, self healing coatings. Corrosion in electronic components – control by vapour phase inhibitors. (6)

M**ETAL FINISHING IN ELECTRONIC INDUSTRY** : Electroplating – plating parameters- polarization and overvoltage, current and energy efficiency. Electroplating of Cu, Ni, and Cr. Electroless deposition of Ni and Cu. Production of plated through hole PCBs, electroforming - fabrication of CD stampers, electrochemical etching of Cu from PCBs, Electrophoretic painting, Electrochemical etching of semiconductors. (6)

ELECTROCHEMICAL POWER SOURCES : Batteries- types, characteristics. Fabrication and working of lechlanche cell, primary lithium cell, lead- acid battery, Ni-metal hydride and lithium ion batteries. Supercapacitors. Fuel cells - Classification, working principle, components, applications of proton exchange membrane, direct methanol and solid oxide fuel cells. Hydrogen as a fuel - production and storage. (6)

SENSORS : Components of electrochemical sensors, electrochemical transducers - potentiometric, amperometric and conductometric methods – ion-selective electrodes – solid-state electrode, liquid ion-exchange membrane electrodes. Gas sensors – CO2, O2 and NH3 sensing. Sensors for health care – glucose and urea. (6)

Total L: 30

TEXT BOOKS:

1. Derek Pletcher and Frank C. Walsh "Industrial Electrochemistry", Chapman and Hall., London, 1993. , 2nd edition
2. John O'M.Bockris and Amulya K. N. Reddy "Modern Electrochemistry 2B", Kluwer Academic/Plenum Publishers., New York, 1998. , 2nd edition

REFERENCES:

1. Dell R. M. and Rand D. A. J "Understanding Batteries", Royal Society of Chemistry., UK, 2001. , 1st edition
2. Brian Eggins "Chemical Sensors and Biosensors", John Willey & Sons., US, 2002. , 1st edition
3. Zaki Ahmad, Digby Macdonald "Principles of Corrosion Engineering and Corrosion Control", Butterworth- Heinemann., London, 2013. , 2nd edition
4. Shashi Chawla —A Textbook of Engineering Chemistry‖, Dhanpat Rai and Co., New Delhi, 2005, 1st edition

19IE 204 ELECTRON DEVICES

3 0 0 3

SEMICONDUCTOR DIODE : Review Of Properties of Semiconductor Materials - Theory of PN Junction Diode and Zener diode - V-I Characteristics and its Temperature dependence - Break down mechanisms - Diode Resistance and Capacitance - Diode 30 Models - Rectifiers - Clipper - Clamper - Voltage regulator - Tunnel Diode and Varactor Diode

(9)

BIPOLAR JUNCTION TRANSISTOR : Transistor types - Transistor Action - Current Components - Ebers Moll Model - Configurations - Transistor as a Switch and Amplifier - Small Signal Low Frequency Hybrid Model - DC and AC Load Lines - Operating Point - Bias stability, Biasing Methods and Bias Compensation (9)

FIELD EFFECT TRANSISTOR : JFET and its Characteristics - JFET parameters and Configurations - MOSFET – Types - V-I Characteristics - Principle of operation - MOSFET Biasing - MOS Capacitor - MOSFET as switch - Comparison of FET and BJT (9)

CMOS : NMOS and PMOS transistors and their characteristics - Threshold voltage - MOS device equations - Second order effects - Small signal MOS model (9)

POWER AND OPTO ELECTRONIC DEVICES : Thyristor Families - SCR, DIAC,TRIAC - Operation and their Characteristics - Application - UJT- Operation - Characteristics - Equivalent Circuit – Applications - Opto Electronic Devices - Photoconductive, Photovoltaic, Photo-emissive Sensors - Laser diode - Photo diodes - Photo Transistors - Light emitters - Liquid Crystal Displays - Plasma and HDTV

(9)

Total L: 45

TEXT BOOKS:

1. Millman J. , Halkias C. C. "Electronic Devices and Circuits ", Tata McGraw Hill, New Delhi, 2011.
2. Floyd T. L "Electronic Devices and Circuits", Pearson Education., New Delhi, 2011

REFERENCES:

1. Boylestad, R. L. and Nashelsky, L. "Electronic Devices and Circuit Theory ", Pearson Education, New Delhi, 2012
2. David A.Bell "Electronic Devices and Circuits", Prentice Hall of India., 2008
3. Robert T.Paynter "Introductory Electronic Devices and Circuits", Pearson Education., USA, 2009
4. Neil.H.E.Weste, Kamran Eshranghian "Principles of CMOS VLSI Design- A system perspective", Addison Wesley., New Delhi, 2009 , second edition

19IE 205 CIRCUIT THEORY

3 1 0 4

CIRCUIT ANALYSIS : Charge and Current, Voltage, Power and Energy, Network Elements - Current and Voltage sources. Kirchoff's Laws - Ohm's Law - Resistive circuits - Series and Parallel reduction method and analysis. Voltage and Current division. Source Transformation. Wye-Delta transformation, Duality - Mesh and Nodal analysis (10+3)

NETWORKS THEOREMS AND GRAPH THEORY : Superposition, Thevenin's and Norton's, Maximum power transfer, Reciprocity theorems, Tellegen's theorems - Network topology, matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. (10+3)

AC CIRCUIT ANALYSIS : Average and RMS values - Phasor representation of variables - Power triangle and average power - Mesh, Node and theorems, Resonance, Magnetically coupled circuits. (7+2)

TIME DOMAIN ANALYSIS : Source free RL and RC circuits, Transient Response of RL and RC circuits for DC excitation and Sinusoidal excitation. Frequency Domain Analysis: Transient Response of RL, RC, RLC circuits for DC and Sinusoidal excitation using Laplace transform, Network functions of single-port network, Driving point and transfer function of Two-port networks, Poles and Zeros of network functions. (11+5)

ANALYSIS OF TWO PORT NETWORK : Network parameters-Impedance, admittance, transmission and hybrid, Conversion formulae. Properties – reciprocity and symmetry - Equivalents of T, Π, Ladder, bridged T and Lattice networks. (7+2)

Total L: 45 + T:15 = 60

TEXT BOOKS:

1. Singh "Network Analysis and Synthesis", McGraw-Hill Education., New Delhi, 2013
2. Alexander C, Sadiku M. N. O "Fundamentals of Electric Circuits", Tata McGraw Hill., New Delhi, 2013
3. Sudhakar A, Shyammohan S. Pillai "Circuits and Networks Analysis and Synthesis", McGraw Hill., New Delhi, 2015 31

REFERENCES:

1. Abhijit Chakrabarthy "Circuit Theory Analysis & Synthesis", Dhanpath Rai & Sons., New Delhi, 2011
2. Nahvi M, Edminister J. A "Theory and Problems Electric circuits", Tata McGraw Hill., New Delhi, 2011

19IE 211 DEVICES AND CIRCUITS LABORATORY

0 0 4 2

1. Verification of Kirchhoff's Voltage and Current laws
2. Verification of Thevenin's theorem and Maximum Power Transfer Theorem
3. PN Junction Diodes and Rectifier circuits
4. Wave shaping circuits: Clippers and clampers
5. Zener Voltage Regulator
6. Evaluation of BJT Hybrid parameters
7. BJT Biasing Techniques
8. Series and parallel resonance circuits
9. MOSFET Characteristics and its application as a switch
10. Simulation : Verification of theorems
11. Simulation : BJT Characteristics
12. Simulation : CMOS characteristics
13. Simulation : Characteristics of Thyristor Family Devices (60)

Total P: 60

REFERENCES:

1. ECE Department "Laboratory Manual".

19IE 212 PYTHON PROGRAMMING LABORATORY

0 0 4 2

PROBLEM SOLVING RELATED TO THE FOLLOWING TOPICS:

1. Programs related to integers, float, complex, Boolean data types in the shell
2. Input/output and conditional statements in scripts
3. Different operator and conversion functions
4. Loops : for and while
5. String datatype: Creation,Operations, Methods
6. Tuple data type:Creation, Operations, Methods
7. Set and frozen set datatypes: Creation,Operations, Methods
8. Dictionary datatype:Creation, Operations, Methods
9. Functions: definitions , parameter passing, returning datatypes
10. Lambda and recursive functions
11. Creating modules and packages
12. Handling exceptions
13. File handling (60)

Total P:60

REFERENCES:

1. Mark Summerfield "Programming in Python 3: A Complete introduction to the Python Language", Addison- Wesley Professional., 2009
2. Reema Thareja "Python Programming : Using Problem Solving Approach", Oxford university Press., 2017 32
3. Paul Barry "Head First Python: A Brain-Friendly Guide", O'Reilly Media., 2016

SEMESTER - 3

19IE 301 LINEAR ALGEBRA AND NUMERICAL ANALYSIS

3 1 0 4

VECTOR SPACE : General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension. (9+3)

SYSTEM OF LINEAR EQUATIONS, EIGENVALUES AND EIGENVECTORS : Errors - approximations and round-off errors – truncation errors, system of linear equations- Naive Gauss elimination method, Crout‘s method, Gauss– Seidel method, eigenvalues and eigenvectors using power method. (9+3)

INTERPOLATION, DIFFERENTIATION AND INTEGRATION : Newton‗s divided-difference interpolating polynomials, Lagrange interpolating polynomials, equally spaced data - Newton‗s forward and backward interpolating polynomials, numerical differentiation – evenly spaced data, numerical integration - Newton-cotes formulae, trapezoidal rule, Simpson‗s 1/3 rule. (9+3)

NUMERICAL SOLUTION TO ORDINARY DIFFERENTIAL EQUATIONS : Numerical methods for initial value problem, Taylorseries, Euler‘s method, modified Euler‘s method, Runge-Kutta method of 4th order, multi step methods - Milne method. (9+3)

NUMERICAL SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS : Finite difference: elliptic equations - the Laplace equation, Poisson equation – Liebmann method, parabolic equations – heat conduction equation – Crank Nicolson‗s method, hyperbolic equations – vibrating string. (9+3)

Total L: 45 + T: 15 = 60

TEXT BOOKS:

1.Howard Anton and Chris Rorres , "Elementary Linear Algebra", Wiley India, New Delhi, 2018.
2.Steven C Chapra and Raymond P Canale , "Numerical Methods for Engineers", Tata McGraw Hill, New Delhi, 2017.

REFERENCES:

1.David C Lay , "Linear Algebra and its Applications", Pearson, New Delhi, 2016.
2.Curtis F Gerald and Patrick O Wheatly , "Applied Numerical Analysis", Pearson, New Delhi, 2017.
3.Richard L Burden and Douglas J Faires , "Numerical Analysis", Thomas Learning, NewYork, 2017.
4.Ward Cheney and David Kincaid , "Numerical Mathematics and Computing", Cengage Learning, USA, 2018.

19IE 302 ANALOG ELECTRONICS

3 0 0 3

POWER SUPPLIES : Half wave and Full wave Rectifiers - Calculation of Ripple factor, Regulation, Rectification efficiency and TUF - Filters - L, C , L-Section and Pi - Voltage Regulators - Series and Shunt - Current limiting and protection circuits. (9)

SINGLE STAGE AMPLIFIERS AND TUNED AMPLIFIERS : BJT and MOSFET amplifiers - calculation of input and output impedance, voltage gain - Frequency Response of Common Source MOSFET Amplifier - Analysis of single tuned amplifiers (9)

DIFFERENTIAL AMPLIFIERS : BJT Current Mirrors- Simple, Widlar, Wilson - Differential amplifier- Differential and common mode gain - CMRR - Circuits for improving CMRR using active load - Cascode and Darlington amplifiers

(9)

POWER AMPLIFIERS AND FEEDBACK AMPLIFIERS : Classification of Power Amplifiers-Class A/B/AB/C/D - Single ended and Push-pull configuration - Feedback Concepts - Effect of negative feedback on voltage and current feedback amplifier circuits

(9)

OSCILLATORS AND MULTIVIBRATORS : Barkhausen criteria - Sinusoidal oscillators - RC, LC and Quartz - Frequency stability of oscillators - Non-sinusoidal oscillators - Multivibrators - Bistable, monostable and astable multivibrators - Schmitt Trigger

(9)

Total L: 45

TEXT BOOKS:

1.Jacob Millman, Christos C Halkias, Satyabrata Jit , "Electronic Devices and Circuits", Fourth Edition, McGraw Hill Education, 2015.
2.Sedra and Smith , "Micro electronic Circuits", Seventh Edition, Oxford University Press, NY,USA, 2017.

REFERENCES:

1.Millman J , Taub H. , "Pulse, Digital and Switching waveforms", Third, McGraw Hill International, 2011.
2.Donald L Schilling , Charles Belove , "Electronic Circuits", 3rd Edition, Tata McGraw-Hill, 2002.
3.Allen Mottershed , "Electronic Devices and Circuits", Prentice Hall of India, 2009. 4.David A Bell , "Electronic Devices and Circuits", Prentice Hall of India, New Delhi, 2008.

19IE 303 DIGITAL ELECTRONICS

3 0 0 3

NUMBER SYSTEMS AND BOOLEAN ALGEBRA : Number systems - Arithmetic operations-computer codes - Boolean algebra – basic postulates and theorems - canonical forms- Standard representation of logic functions- K-maps and Quine McClusky method- Modeling using Verilog. (9)

COMBINATIONAL LOGIC DESIGN : Binary / BCD adders, Subtractors, encoders, decoders, multiplexers and demultiplexers - Carry look ahead adder – Multiplier - magnitude comparator – ALU - Verilog implementation of Combinational logic circuits (9)

SYNCHRONOUS SEQUENTIAL CIRCUITS : Flip-flops- latches - Shift registers- synchronous counters- Design and analysis of clocked sequential circuits- state reduction techniques-Sequence detector- Verilog implementation of sequential logic circuits. (9)

ASYNCHRONOUS SEQUENTIAL CIRCUITS : Fundamental and pulse mode circuits-Design of fundamental mode asynchronous sequential circuits-Binary / BCD Ripple counter – Races - Hazards.

(8)

PROGRAMMABLE LOGIC DEVICES AND LOGIC FAMILIES : Classification of memories, Read/write operations- Memory decoding and expansion, Static and Dynamic RAM- PLDs- Architecture and implementation - Digital logic families - Characteristics - TTL,ECL and CMOS logic. (10)

Total L: 45

TEXT BOOKS:

1.Morris Mano, and M.D. Ciletti , "Digital Design: with an introduction to Verilog HDL, VHDL and system verilog", 6th Edition, Pearson, New Delhi, 2018.
2.Joseph Cavanagh , "Digital Design and Verilog HDL Fundamentals", CRC Press, 2015.

REFERENCES:

1.Charles Roth, Lizy kurian john , "Digital Systems Design using Verilog", 1st Edition, cengage India private limited, 2016.
2.Floyd T L , "Digital Fundamentals", 11th Edition, Pearson education, New Delhi, 2015.
3.A Anandkumar , "Fundamentals of Digital circuits", 4th Edition, Prentice Hall of India, New Delhi, 2016.

19IE 304 ELECTROMAGNETIC FIELDS AND WAVES

3 1 0 4

ELECTROSTATIC FIELDS : Review of vector calculus and Co-ordinate systems - Electrostatic fields - Coulomb's Law and field intensity - Electric flux density - Gauss's law and its application - Electric potential - Relationship between E and V-Flux lines - Dipole- Energy density - Conductors - Boundary conditions in electrostatic fields – Boundary value problems (12+4)

MAGNETOSTATIC FIELDS : Biot-Savart's Law - Ampere's circuital law - Magnetic flux density and Maxwell's equations – Magnetic forces due to magnetic fields - Magnetic -Scalar and Vector potential - Magnetic Boundary conditions – Boundary value problems – Magnetic energy. (12+4)

TIME VARYING FIELDS : Faraday‘s Law – Equation of continuity - Inconsistency of Ampere's law - Maxwell's equations and their interpretation – Time varying Potentials (5+2)

ELECTROMAGNETIC WAVES : Uniform plane waves- Wave equation - Wave propagation in different media - Poynting Vector and Theorem – wave Polarization - Reflection of a plane wave at Normal and Oblique incidence - EMI / EMC Interference. (8+3)

TRANSMISSION LINES AND WAVEGUIDES : Transmission line-parameters-VSWR- reflection coefficient - stub matching using Smith chart - Rectangular waveguide – TE and TM modes and propagation characteristics – Impossibility of TEM waves. (8+2)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1.Sadiku M H , "Principles of Electromagnetics", Oxford University Press Inc, New Delhi, 2015.
2.William H Hayt , "Engineering Electromagnetics", 8th Edition, McGraw Hill international Edition, New Delhi, 2012.

REFERENCES:

1.David K Cheng , "Fields and Wave Electromagnetics", 2nd Edition, Pearson Education, 2013.
2.Umran S. Inan, Aziz Inan, Ryan Said , "Engineering Electromagnetics and Waves", 2nd Edition, Pearson, 2015.

19IE 305 DATA STRUCTURES AND ALGORITHMS

2 2 0 4

INTRODUCTION: Data types – Abstract data types – Types of Data structures- Algorithms- properties – Design and development of algorithm - Recursive Algorithms- Analysis of Algorithms - Best case, Average case, Worst case - Asymptotic Notations. (6+6)

LINEAR DATA STRUCTURES: Arrays-operations – Memory Representation- Row Major and Column Major – Multi Dimensional Arrays – Sparse Matrix, Dense Matrix. Stack: Array implementation – operations-Applications – Checking of wellformedness Parenthesis Infix to Postfix –Conversions. (6+6)

QUEUES: Queue Operations-Circular Queue - Priority Queues - Array Implementation of Queue. Linked List: Types-Singly Linked List – Circularly Linked List – Doubly Linked List–List operations. (6+6)

NONLINEAR DATA STRUCTURES: Trees-Terminologies - Binary trees – Representations – Operations – TraversalsInorder, Preorder and Postorder- Binary Search Trees – Insertion and deletion. Graph: Terminologies - Breadth First Search algorithm- Depth First Search Algorithm. (6+6)

SORTING AND SEARCHING : Bubble Sort – Insertion Sort – Radix Sort- Quick sort- Algorithms and Time Complexity. Linear Search – Binary Search – Hashing: Hash functions – Separate Chaining – Open Addressing – Linear Probing. (6+6)

Total L: 30 +T: 30 = 60

TEXT BOOKS:

1.Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein , "Introduction to Algorithms", The MIT Press, 2014.
2.Mark Allen Weiss , "Data Structures and Algorithm Analysis in C++", Pearson Education, 2012.

REFERENCES:

1.Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran , "Fundamentals of Computer Algorithms", Second, Universities Press, 2011.
2.Sahni Sartaj , "Data Structures, Algorithms and Applications in C++", Silicon Press, 2009.
3.Aaron M Tanenbaum, Moshe J Augenstein, YedidyahLangsam , "Data structures using C and C++", PHI Learning, 2009.
4.G A V Vijayalakshmi Pai , "Data Structures and Algorithms Concepts, Techniques and Allocations", McGraw Hill Education (India) Private Limited, New Delhi, 2015.

19IE 306 ECONOMICS FOR ENGINEERS

3 0 0 3

INTRODUCTION : Definition – Nature and Scope – Central Problems of an Economy – Positive and Normative Economics– Micro Economics and Macro Economics, Significance of Economics, Economic Assumptions (9)

THEORY OF CONSUMER BEHAVIOR : Utility – Indifference Curve Analysis - Properties, Consumer‘s Budget Line - Demand Analysis: Demand Function and Law of Demand, Elasticity of Demand. Demand forecasting using Econometric Techniques. Supply – Factors Affecting Supply, Market Equilibrium Price, Consumer Surplus. (9)

PRODUCTION, COST AND REVENUE : Production Function, Total Product, Average Product and Marginal Product, Returns to Scale. Costs, Nature of Costs, Short-run and Long-run Cost Curves, Revenue concepts. (9)

MARKET STRUCTURE : Types of Markets - Perfect Competition – Characteristics – Imperfect Competition: Monopoly – Monopolistic Competition – Oligopoly and Duopoly - Price Discrimination and Product Differentiation under Different Markets – Price and Output Determination in Short run and Long run and profit maximization. (9)

PERFORMANCE OF AN ECONOMY (MACRO ECONOMICS) : Demand and Supply of Money – Quantity Theory of Money, Banking – Functions of Commercial Banks and Central Bank – Inflation – Causes – Control Measures – National Income – Concepts – Methods of Calculating National Income – Problems in Calculating National Income. (9)

Total L: 45

TEXT BOOKS:

1.Varian H.R. , "Intermediate Microeconomics", East– West Press, New Delhi, 2014.
2.Dewett.K.K, Navalur. M.H. , "Modern Economic Theory", S. Chand, New Delhi, 2015.

REFERENCES:

1.William A, McEachern, Simrit Kaur , "Micro ECON", Cengage Learning, Noida, 2013.
2.William A, McEachern, Indira A. , "Macro ECON", Cengage Learning, Noida, 2014.
3.Deepashree , "Principles of Economics", Ane Books Pvt Ltd, New Delhi, 2010.
4.Dwivedi , "Essentials of Business Economics", Vikas Publishing House Pvt Ltd, New Delhi, 2010.

19IE 310 ANALOG ELECTRONICS LABORATORY

0 0 2 1

HARDWARE EXPERIMENTS :

1) Full Wave Rectifiers with and without filters
2) Series voltage regulators
3) BJT amplifiers.
4) FET amplifiers
5) RC phase shift and Colpitt‘s oscillators
6) Class B and Class AB amplifiers
7) Astable multivibrators
8) Monostable and Bistable multivibrators
9) Schmitt Trigger
10) Feedback Amplifiers (20)

SOFTWARE EXPERIMENTS :

1) BJT current mirrors
2) Differential amplifiers
3) MOS CS amplifier with resistive load and current source load (10)

Total P: 30

TEXT BOOKS:

1.Millman J and Taub H , "Pulse, Digital and Switching waveforms", McGraw Hill International, New Delhi, 2011.
2.David A Bell , "Electronic Devices and Circuits", Prentice Hall of India, New Delhi, 2008.

19IE 311 DIGITAL ELECTRONICS LABORATORY

0 0 2 1

HARDWARE EXPERIMENTS :

1) Half adder and Full adder
2) Code Conversion: BCD to Gray and Seven segment conversion
3) Multiplexers/Demultiplexers
4) Flip-flops
5) Shift Registers
6) Ring Counter and Johnson Counter (15)

SOFTWARE EXPERIMENTS :

1) Adder / Subtractor Circuits and BCD adder using verilog code
2) Magnitude Comparator and ALU using verilog code
3) Synchronous Counters using verilog code
4) Asynchronous counters using verilog code
5) Sequence Detector using verilog code (15)

Total P: 30

TEXT BOOKS:

1.Morris Mano, and M.D. Ciletti , "Digital Design: with an introduction to Verilog HDL, VHDL and system verilog", 6th Edition, Pearson Education, New Delhi, 2018.

SEMESTER – 4

19IE 401 PROBABILITY AND RANDOM PROCESSES

3 1 0 4

PROBABILITY : Probability axioms, some consequences of the axioms, conditional probability, law of total probability, Baye‘s theorem, independence, sequential experiments and tree diagrams, reliability problems. (9+3)

RANDOM VARIABLES : Discrete random variables – probability mass function, binomial, Poisson and geometric random variables, cumulative distribution function, expectations. Continuous random variables – probability density function, uniform, exponential, Gaussian random variables, expectations. (9+3)

PAIRS OF RANDOM VARIABLES : Joint cumulative distribution function, joint probability mass function, marginal probability mass function, joint probability density function, marginal probability density function, expected values, independent random variables, covariance. (9+3)

STOCHASTIC PROCESSES : Types of stochastic processes – Poisson process, Brownian motion process, expected value and correlation, stationary processes, wide sense stationary stochastic process, cross-correlation. (9+3)

RANDOM SIGNAL PROCESSING : Linear filtering of a continuous-time stochastic process, linear filtering of a random sequence, power spectral density of a random sequence. (9+3)

Total L: 45 + T: 15 = 60

TEXT BOOKS:

1.Roy D.Yates and David J Goodman , "Probability and Stochastic Processes – A friendly Introduction for Electrical and Computer Engineers", Wiley India, New Delhi, 2014.
2.Saeed Ghahramani , "Fundamentals of Probability with Stochastic Processes", CRC Press, Taylor & Francis Group, USA, 2018.

REFERENCES:

1.Kishore S. Trivedi , "Probability and Statistics with reliability, queueing and computer science applications", PHI Learning Pvt Ltd, New Delhi, 2016.
2.Sheldon M. Ross , "Stochastic Processes", Wiley India, New Delhi, 2016.
3.Athanasios Papoulis and Unnikrishna Pillai S , "Probability, Random Variables and Stochastic Processes", Tata McGrawHill, New Delhi, 2011.
4.William Feller , "An Introduction to probability theory and its applications", Wiley India, New Delhi, 2013.

19IE 402 LINEAR INTEGRATED CIRCUITS

3 0 0 3

OPERATIONAL AMPLIFIERS AND ITS CHARACTERISTICS : Operational Amplifier: Fundamental block diagram - Characteristics of an Ideal Operational Amplifier - -DC and AC characteristics-frequency response - circuit stability (9)

APPLICATION OF OPERATIONAL AMPLIFIERS : Linear applications- DC&AC amplifiers, summing differential amplifier, instrumentation amplifier, V to I and I to V converters, Integrator, Differentiator. First/second order low/ high/ band pass, band reject active filters, All pass filter - Phase shift oscillator, Wein bridge oscillator, Square wave and triangular waveform generators. - Nonlinear applications - Comparators, Schmitt Trigger, Clipping and Clamping circuits, Absolute value circuits, Peak detectors, Sample and hold circuits, Log and antilog amplifiers. (9)

555 FAMILY ICS AND PHASE LOCKED LOOP : 555 Timer - monostable and astable modes of operation – Applications - Voltage Controlled Oscillator, Phase Locked Loop – operating principles and applications. (9)

A-D AND D-A CONVERTERS : Digital to Analog converters - Binary weighted and R-2R Ladder types - Analog to digital converters - Sample and Hold circuit - Continuous - Counter ramp, successive approximation, single, dual slope and parallel types - DAC/ADC performance characteristics and comparison. (9)

VOLTAGE REGULATORS : Fixed voltage regulators- adjustable voltage regulators - IC Voltage regulators—Buck & Boost regulators - Switching regulators (9)

Total L: 45

TEXT BOOKS:

1.Roy Choudhury , "Linear Integrated Circuits", 4th Edition, Wiley Eastern, New Delhi, 2014.
2.James.M.Fiore , "OP- AMPS and Linear Integrated Circuits-concepts and applications", 3rd Edition, cenage learning india,, NEW DELHI, 2019.

REFERENCES:

1.Michael Jacob J , "Analog Integrated Circuits and Applications", 1st Edition, Prentice Hall of India,, New Delh, 2019.
2.Robert F Coughlin and Fedrick F Driscoll. , "Operational amplifiers and linear Integrated Circuits", Fifth, Prentice Hall of India,, New Delhi, 2014.

19IE 403 SIGNALS AND SYSTEMS

3 0 0 3

INTRODUCTION TO SIGNALS AND SYSTEMS : Basic Continuous-time (CT) & Discrete-Time (DT) signals - Operations - Classification - Properties of CT & DT systems – Analysis of LTI systems - Convolution Sum - Convolution Integral – Properties (15)

FOURIER ANALYSIS OF CT SIGNALS AND SYSTEMS : Representation of CT periodic signals by Continuous Time Fourier Series - Convergence - Properties - Representation of CT aperiodic and periodic signals by Continuous Time Fourier Transform - Convergence - Properties - Frequency response of systems characterized by differential equations (8)

FOURIER ANALYSIS OF DT SIGNALS AND SYSTEMS : Representation of DT periodic signals by Discrete Time Fourier Series - Properties - Representation o f DT aperiodic and periodic signals by Discrete Time Fourier Transform – Convergence - Properties - Frequency response of systems characterized by difference equations. (8)

SAMPLING : Representation of CT signals by samples – Impulse train sampling - Effects of under sampling - Reconstruction of CT signal from samples using interpolation (6)

Z TRANSFORM ANALYSIS OF DT SIGNALS AND SYSTEMS : z- transform - Properties - Inverse z-transform - Partial fraction and Cauchy Residue methods - Analysis of LTI systems using z transform- Stability and causality in z-domain - Solution of difference equations (8)

Total L: 45

TEXT BOOKS:

1.Alan V Oppenheim, Alan S Willsky, S Hamid Nawab , "Signals and Systems", second Edition, PHI Learning Private Limited, New Delhi, 2015.
2.Krishnaveni.V, Rajeswari.A , "Signals and Systems", First Edition, Wiley India Pvt.Ltd, 2012.

REFERENCES:

1.Haykin. S and Barry Van Veen , "Signals and Systems", Second Edition, John Wiley and Sons, 2012.
2.Hsu.H.P, Rakesh Ranjan , "Signals and Systems", Second Edition, Schaums's Outlines, Tata McGraw Hill, 2010.
3.Samir S. Soliman, Mandyam Dhati Srinath , "Continuous and Discrete Signals and Systems", Second Edition, PrenticeHall International, 2011.
4.Luis F. Chaparro , "Signals and Systems Using MATLAB", 1st Edition, Academic Press, An Imprint of Elsevier, 2011.

19IE 404 MEASUREMENTS AND INSTRUMENTATION

2 1 0 3

MEASUREMENTS : Significance and methods of measurements – Standards and their classification. calibration - functional elements of a measurement system - errors in measurements and statistical analysis – Introduction to VI software (4+2)

INDICATING INSTRUMENTS : PMMC Mechanism - D'ARSONAL Galvanometer - DC Ammeters and voltmeters - Measurement of resistance, inductance and capacitance using dc and ac bridges - AC voltmeters using rectifiers - digital voltmeters – Multimeter - VSWR meter - Frequency meter (6+3)

SIGNAL SOURCES AND ANALYSERS : Function generator and pulse generators, Oscilloscopes – DSO and MSO, Harmonic Distortion and spectrum Analyzers, Digital Recorders and printers, 3D printing - Realization of signal sources and analyzers (7+3)

TRANSDUCERS : Classification and selection of Transducers - Strain, Load, Force, Displacement, Velocity, Acceleration - Pressure and Temperature Measurements – Microphone and speakers - Smart sensors and MEMS - Interfacing of transducers (6+4)

DATA ACQUISITION SYSTEMS (DAS) : Block Diagram – Specifications, various components and Applications of DAS - Realization of DAS (7+3)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1.Albert D Helfrich, Cooper. W.D , "Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, New Delhi, 2009.
2.Sawhney A K , "A course in Electrical and Electronic Measurement and Instrumentation", 19th Edition, Dhanpat Rai and Co. (P) Ltd, New Delhi, Reprint 2019.

REFERENCES:

1.Joseph J Carr , "Elements of Electronic Instrumentation and Measurement", Pearson Education, New Delhi, 2008.
2.Nakra B C, Choudhury K.K , "Instrumentation Measurement and Analysis", Tata McGraw Hill, New Delhi, 2004.
3.Jovitha Jerome , "Virtual Instrumentation Using LabView", Prentice Hall of India, New Delhi, 2010.
4.Garry M Johnson , "Lab View Graphical Programming", Tata McGraw Hill, New Delhi, 2010.

19IE 405 COMPUTER ARCHITECTURE

3 1 0 4

INTRODUCTION : Generation of computer systems - Elements of computer - CPU organization - Instruction formats - Addressing modes - Instruction types - CISC and RISC architectures - Multicore architectures (9+3)

DATA PATH DESIGN : Fixed point arithmetic - adder / subtractor - Signed magnitude multiplication algorithm - Robertson multiplication algorithm - Booth's and modified Booths multiplication algorithm - non-restoring division algorithm - restoring division algorithm - floating point arithmetic - addition, subtraction, multiplication and division - ALU - Verilog implementation of datapath components (9+3)

CONTROL LOGIC DESIGN : Control organization - Hardwired Control - one flip flop per state - sequence register and 40 decoder - PLA control - Micro programmed control - performance enhancement techniques - parallel processing - arithmetic pipeline, instruction pipeline - Amdhal's law - Measuring CPU performance – Verilog implementation of control logic components (9+3)

MEMORY ORGANIZATION : Basic Concepts - Memory Hierarchy - Main Memory - Auxiliary Memory – Associative Memory - Cache and Virtual Memory - SDRAM, DDRAM, QDRAM - Flash memories (9+3)

INPUT / OUTPUT AND SYSTEM ORGANIZATION : Input / Output Interface - Synchronous Data Transfer - Asynchronous Data Transfer - Modes of data transfer - I/O Processor - Interrupts - vectored and non vectored – Communication methods - Buses - Bus control - Bus interfacing - Bus arbitration (9+3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1.Morris Mano M , "Digital Logic and computer design", Pearson Education, New Delhi, 2013.
2.Hayes J P , "Computer architecture and Organization", McGraw Hill, New Delhi, 2012.

REFERENCES:

1.Stallings W , "Computer Organization and Architecture: Designing for performance, Pearson Education, New Delhi, Seventh Edition ,2005.", 2005.
2.Patterson D , Hennessy J , "Computer Organization and Design: The Hardware/Software Interface", Morgan Kaufmann Publishers, 2007.
3.Hayes J P , "Computer architecture and Organization", McGraw Hill, New Delhi, 2002.

19IE 406 ANTENNAS AND WAVE PROPAGATION

3 1 0 4

FUNDAMENTALS OF ANTENNA : Types of antennas- Radiation mechanism- current distribution on a thin wire antennaAntenna parameters- Radiation Pattern, Beam solid angle, Radiation intensity, Radiation Power density, Directivity, Gain, Effective aperture, Polarization, Bandwidth, Beam width, antenna impedance, Poynting vector-Friis Transmission formula, Duality of Antennas, Antenna and Transmission lines, Radiation from a dipole antenna. (9+3)

SMALL ANTENNAS : Radiation fields of point source, infinitesimal dipole, and half-wave dipole, Radiation resistance, Directivity and Design procedure- impedance matching of antennas- Smith chart, quarter wave matching (9+3)

ANTENNA ARRAYS : Definition, Power patterns, Array of two point sources – Pattern multiplication, Broad side array, End fire array, N-element linear array, Evaluation of null directions and maxima, amplitude distributions, Binomial arrays, Dolph - Chebychev arrays (9+3)

SPECIAL ANTENNAS : Design procedure and Selection of antenna based on frequency of operation and application, Types of Antennas- Yagi -Uda , Turnstile, Log periodic, Loop and helical - normal mode and axial mode. Phased array- Rhombic - Horn - Reflector and their feed systems - Micro strip - Rectangular patch (9+3)

ANTENNA MEASUREMENTS AND WAVE PROPAGATION : Antenna ranges- Measurement of radiation pattern, Gain, directivity and impedance measurements- Polarization measurements- scale model measurements. Propagation in free space - Surface wave - structure of the ionosphere - determination of critical frequencies - maximum usable frequency - effect of the earth‘s magnetic field – ionospheric variations – fading – tropospheric propagation - space wave propagation- super refraction -refractive index of troposphere (9+3)

Total L: 45 + T: 15 = 60

TEXT BOOKS:

1.Balanis E S , "Antenna Theory Analysis and Design", 5th Edition, John Wiley and Sons Inc, Singapore, 2016.
2.Prasad K D , "Antennas and Wave Propagation", 12th Edition, Satya Prakash, Tech India Publications, New Delhi, 2019.

REFERENCES:

1.Harish A R, and Scahidananda M , "Antennas and Wave Propagation", 3rd Edition, Oxford University Press,, Chennai, 2018.
2.Edward C Jordan, Keith G Balmain , "Electromagnetic waves and Radiating systems", 5th Edition, Prentice Hall of India, New Delhi,2018.

19IE 410 LINEAR INTEGRATED CIRCUITS LABORATORY

0 0 2 1

HARDWARE EXPERIMENTS :

1) Inverting, Non-Inverting and Differential amplifiers, Integrator and Differentiator
2) Rectifier using precision diodes
3) Active low-pass, High-pass and band-pass filters
4) Comparators and Schmitt Trigger using op-amp
5) Phase shift and Wien bridge oscillators using op-amp
6) Astable and monostable multivibrators using NE555 Timer.
7) Digital to Analog Converters and Analog to Digital converters
8) Low Dropout Voltage Regulator
9) Study of PLL characteristics (20)

SOFTWARE EXPERIMENTS :

1) Instrumentation amplifier
2) Universal filter.
3) Analog multiplier
4) Voltage Controlled Oscillator.
5) Phase Locked Loop
6) Frequency Multiplier using IC PLL. (10)

Total P: 30

TEXT BOOKS:

1. Roy Choudhury and Shail Jain , "Linear Integrated Circuits", 4th Edition, Wiley Eastern, Wiley Eastern, 2014.

19IE 411 SIGNALS AND SYSTEMS LABORATORY

0 0 2 1

SOFTWARE EXPERIMENTS :

1) Generation of Continuous Time (CT) signals and Discrete Time (DT) signals
2) Signal operations on CT and DT signals
3) Verification of CT and DT System properties
4) Linear Convolution
5) Analysis and Synthesis of CT periodic signals using Fourier Series and study of Gibbs phenomenon
6) Analysis and Synthesis of CT aperiodic signals using Fourier Transform
7) Analysis and Synthesis of DT periodic signals using Fourier Series
8) Analysis and Synthesis of DT aperiodic signals using Fourier Transform
9) Sampling and Reconstruction
10) Analysis of DT systems using z-transform (30)

Total P: 30

TEXT BOOKS:

1.Krishnaveni.V, Rajeswari.A , "—Signals and Systemsǁ", First Edition, Wiley India Pvt.Ltd, 2012.
2.Luis F. Chaparro , "—Signals and Systems Using MATLABǁ", 1st Edition, Academic Press, An Imprint of Elsevier, 2011. Department of ECE,PSG college of Technology

SEMESTER – 5

19IE 502 COMMUNICATION ENGINEERING

3 0 0 3

AMPLITUDE MODULATION SYSTEMS : Communication system model – Amplitude Modulation – DSBFC, DSBSC, SSB - Generation and detection of DSB-FC, DSB-SC, SSB waves, Vestigial Sideband Modulation, Independent Sideband Modulation - Comparison of AM systems - FDM (9)

ANGLE MODULATION SYSTEMS : FM and PM - Narrow band FM and Wideband FM - Bandwidth requirements- Carson's Rule - Pre emphasis, De-emphasis - Generation and demodulation of FM waves – FM Stereo Multiplexing. (9)

NOISE IN COMMUNICATION SYSTEMS : Types of Noise – Noise Calculations – Equivalent Noise Bandwidth – Noise Figure – Effective Noise Temperature – Narrowband Noise representation- Noise in CW Modulation systems, Noise in Linear Receiver using coherent detection, Noise in AM receivers using envelope Detection – Noise in FM receivers. (9)

TRANSMITTERS AND RECEIVERS : Transmitter characteristics & Classification - Low Level and High Level transmitters - AM broadcasting transmitters - Pilot carrier technique- FM transmitters. Receiver - characteristics and Classification- Tuned radio frequency receiver - Super heterodyne receiver – AM and FM receivers. (9)

PULSE MODULATION SCHEMES : Pulse Amplitude Modulation – TDM - Pulse Width Modulation – Pulse Position Modulation – Pulse Frequency Modulation –Quantization - PCM – Delta Modulation – Adaptive Delta Modulation – Delta Sigma Modulation – DPCM (9)

Total L: 45

TEXT BOOKS:

1.Simon Haykin , "Communication Systems", Wiley, 2014.
2.Kennedy G , "Electronic Communication systems", Tata McGraw Hill, 2017.

REFERENCES:

1.Herbut Taub, Donald L. Schilling, Goutam Saha , "Principles of Communication Systems", McGraw Hill, 2017.
2.Carlson A B , "Communication systems: An Introduction to signals and noise in electrical communication", McGraw Hill, 2010.
3.Dennis Roddy, John Coolen , "Electronic Communications", Prentice Hall of India, 2013.
4.Lathi B P , "Modern Digital and Analog communication Systems", Oxford University Press, 2017

19IE 503 MICROPROCESSORS AND MICROCONTROLLERS

3 0 0 3

MICROCONTROLLER ARCHITECTURE AND INSTRUCTION SET : Functional block diagram of 8051-power supply, clock and reset circuits-program and data memory organization-addressing modes and instruction set – assembly language programming. (9)

ON-CHIP PERIPHERALS AND PROGRAMMING : Architecture and programming of Parallel Port - timer/counter – Serial Port: UART. Hardware and software Interrupts - Power saving modes. (9)

OFF-CHIP PERIPHERALS INTERFACING AND PROGRAMMING : Display interfacing: LED, 7-segment, LCD - Keyboard interfacing: Push-to-On switch and matrix keyboard - Data convertors: ADC and DAC. (9)

ARM CORTEX-M ARCHITECTURE : ARM architecture, Programmers model, memory, Interrupts and exceptions - Memory Protection Unit (MPU) –Floating Point Unit (FPU) (9)

ARM CORTEX INSTRUCTION SET : Moving the data within the processor-memory access-arithmetic-logic- conversion- bit field-compare and test-program flow control-exception-sleep Mode, SIMD-Saturation-MAC-Floating Point Instructions. (9)

Total L: 45

TEXT BOOKS:

1.Muhammad Ali Mazidi, J.G. Mazidi, R.D. McKinlay , "The 8051 Microcontroller and Embedded Systems", Second Edition, Pearson Education Limited, 2014.
2.Joseph Yiu , "The Definitive Guide to ARM Cortex M3 and Cortex M4 Processors", Third, Newnes, 2014.

REFERENCES:

1.Steve Furber , "ARM System-on – Chip Architecture", Second Edition, Addison Wesley, Pearson Education Limited, 2000.
2.Andrew Sloss, Dominic Symes, Chris Wright , "ARM System Developers Guide: Designing and Optimizing System Software", Morgan Kaufmann, 2004

19IE 504 CONTROL SYSTEMS

3 0 0 3

INTRODUCTION : Modeling of Electrical and Mechanical systems - Translational and Rotational systems – Block diagram – Signal flow graph - Mason's gain formula. (9)

TIME AND FREQUENCY DOMAIN ANALYSIS : Standard Test signals – Time response of second order systems - Performance specifications on system time response - Types of systems - Steady state error - Generalized error series - Introduction to PID Controllers –Performance specifications on system Frequency response – Correlation between time and frequency response. (9)

STABILITY ANALYSIS : Concepts of Stability - Routh Stability Criterion - Root locus technique (6)

FREQUENCY RESPONSE PLOTS AND SYSTEM STABILITY : Polar plot - Nyquist stability Criterion - Bode plot - Compensator design using Bode Plot. (12)

STATE VARIABLE ANALYSIS : Introduction –State space representation of continuous time systems using Physical and Phase Variables – Solution of state equations–Concepts of Controllability and Observability (9)

Total L: 45

TEXT BOOKS:

1.M.Gopal , "Control System – Principles and Design", 4th Edition, Tata McGraw Hill, 2012.
2.Norman Nise , "Control System Engineering", 6th Edition, John Wiley & Sons, 2019.

REFERENCES:

1.Benjamin.C.Kuo , "Automatic control systems", 7th Edition, Prentice Hall of India, 1995.
2.J.Nagrath, M.Gopal , "Control System Engineering", 5th Edition, New Age International Publishers, 2007.
3.Smarahit Ghosh , "Control Systems Theory and Applications", Pearson Eduation Asia, 2012.
4.Katsuhiko Ogata , "Modern Control Engineering", 5th Edition, PHI, 2012. 5.S.K.Bhattacharya , "Control System Engineering", 3rd Edition, Pearson, 2013

19IE 505 COMPUTER NETWORKS

3 1 0 4

INTRODUCTION AND QUEUING PRINCIPLES : Network Criteria - Network Types - Transmission modes - Network Models: OSI Model, TCP/IP model - Digital to Digital Conversion – Digital Data Transmission - Transmission Media – Multiplexing – Switching - Connecting devices - Simple Queuing Models, M/M/n queues, M/G/1 queues, Queues with blocking and priority queues (12+3)

DATA LINK LAYER : Error Detection and Correction - Data Link Control and Protocols - Wired LANs: Ethernet, Token bus, Token ring, FDDI - Virtual LAN (9+3)

NETWORK LAYER : IPv4 addressing - Classful and Classless addressing, Subnetting – NAT – DHCP – ICMP – IGMP – Routing Algorithms: Distance Vector, Link State – Progression to IPv6 - Network Layer Performance (9+3)

TRANSPORT LAYER : Process to process delivery – UDP – TCP – SCTP – Congestion control – Quality of Service (8+3)

APPLICATION LAYER : Client Server Programming – WWW – HTTP – FTP – Email – Telnet – DNS – SNMP – VoIP (7+3)

Total L: 45 + T: 15 = 60

TEXT BOOKS:

1.Behrouz A Forouzan , "Data Communication and Networking", 5th Edition, Tata McGraw-Hill, New Delhi, 2013.
2.Kurose James F, Keith W. Ross , "Computer Networking: A Top-Down Approach", 7th Edition, Pearson Education, New Delhi, 2016.

REFERENCES:

1.Andrew S Tanenbaum , "Computer Networks", Prentice Hall of India, New Delhi, 2011.
2.William Stallings , "Data and Computer Communication", Prentice Hall of India, New Delhi, 2014.
3.Larry L. Peterson, Bruce S. Davie , "Computer Networks: A Systems Approach", Morgan Kauffmann Publishers Inc, 2012.
4.Keizer G.E , "Local Area Networks", 2nd Edition, McGraw Hill, New Delhi, 2001.

19IE 510 COMMUNICATION ENGINEERING LABORATORY

0 0 2 1

HARDWARE EXPERIMENTS :

1) Amplitude Modulation and Demodulation
2) DSB-SC Modulation and Demodulation
3) Pre emphasis and De emphasis circuits
4) Frequency Modulation and Demodulation
5) Automatic Gain Control circuits
6) Single tuned amplifier
7) Audio Amplifier
8) Pulse Modulation Scheme
9) TDM and FDM systems (15)

SOFTWARE EXPERIMENTS :

1) PCM and DPCM
2) Delta Modulation and Adaptive Delta Modulation for speech signals
3) Figure of Merit Analysis of AM and FM (15)

Total P: 30

REFERENCES:

1. Simon Haykin , "Communication Systems", Wiley, 2014.

19IE 511 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

0 0 2 1

SOFTWARE EXPERIMENTS :

1) Addition and Subtraction of Single and Multi byte data
2) Multiplication and Division of Single and Multi byte data
3) Searching the given number using Linear / Binary Search Algorithm
4) Sorting the given numbers using Bubble/Insertion Algorithm
5) Code Conversion Techniques (15)

HARDWARE EXPERIMENTS :

1) Interfacing Display Unit
2) Interfacing Keyboard Unit
3) Timer/Counter Interfacing Techniques
4) Hardware and Software Interrupts
5) UART Programming Techniques (15)

Total P: 30

SEMESTER - 6

19IE 601 DIGITAL SIGNAL PROCESSING

3 0 0 3

DISCRETE FOURIER TRANSFORM (DFT) : Review of CTFT & DTFT - DFT – Properties - Radix 2 FFT algorithms - Decimation in time - Decimation in frequency - Use of FFT in Linear filtering - Filtering of long data sequences (8)

DESIGN AND REALIZATION OF IIR FILTERS : Review of design techniques for analog low pass filters - Design of IIR filters - Approximation of derivatives - Impulse Invariance - Bilinear transformation - Butterworth and Chebychev Type 1 filters - Realization of IIR filters. (10)

DESIGN AND REALIZATION OF FIR FILTERS : FIR filters - Symmetric and anti symmetric FIR filters - Design of linear phase FIR filters using windows - Realization of FIR filters (10)

ANALYSIS OF FINITE WORD LENGTH EFFECTS : Representation of Numbers - Quantization of filter coefficients in IIR and FIR filters - Roundoff effects in Digital filters - Quantization effects in computation of DFT (10)

PROGRAMMABLE DIGITAL SIGNAL PROCESSORS : Introduction to Digital Signal Processors - Architecture of TMS320C6748 - Device characteristics - Memory mapping - Peripherals (7)

Total L: 45

TEXT BOOKS:

1.Lonnie C Ludeman , "Fundamentals of Digital Signal Processing", Wiley India, New Delhi, 2011.
2.John G Proakis and Dimitris G Manolakis , "Digital Signal Processing", Prentice Hall India, New Delhi, 2010.

REFERENCES:

1.Oppenheim A V , "Discrete Time Signal Processing", Prentice Hall India, New Delhi, 2010.
2.Mitra S K , "Digital Signal Processing – A Computer based Approach", Tata McGraw Hill, New Delhi, 2012.
3.Vinay K Ingle, John G Proakis , "Digital signal processing using MATLAB", Brooks / Cole, California,United States, 2011.

19IE 602 DIGITAL COMMUNICATION

3 0 0 3

INFORMATION THEORY : Review of Probability theory and random process - Self information measure - Entropy function - Conditional Entropies - Mutual information - Redundancy - Efficiency and channel capacity - capacities of channels with symmetric noise structure Shannon‘s Hartley Law. (8)

BASEBAND SIGNALLING : Power Spectral Density - Concept of base band signaling - Signaling formats – Line coding - Optimum Filtering - Error due to Noise – ISI - Pulse Shaping - Scrambling and unscrambling - channel equalization, tapped delay line and Transversal filters (9)

PASSBAND SIGNALLING : Signal Space Analysis - Detection using matched filters for signals via AWGN channels - Analysis of coherent and non coherent detection Schemes for ASK, FSK, PSK, DPSK - M-ary signaling – MSK – GMSK – QAM - Probability of error for each scheme - Multicarrier modulation – OFDM (10)

SPREAD SPECTRUM AND SYNCHRONIZATION : PN sequences - Direct Sequence Spread spectrum – Frequency Hop Spread Spectrum - Need for Synchronization - Bit, word and frame synchronization - Early-Late Gate Synchronizer (9)

ERROR CONTROL CODING : Parity check codes - Linear block codes – Decoding of linear Block codes - Polynomial representation of code structures - cyclic codes - convolution codes –The Generating function-Viterbi Decoding algorithms - turbo codes (9)

Total L: 45

TEXT BOOKS:

1.Simon Haykin , "Digital Communications", John Wiley & Sons, Inc, Singapore, 2011.
2.Lathi B P , "Modern Digital and Analog communication Systems", Oxford University Press, 2010.

REFERENCES:

1.Proakis J G, Salehi M , "Digital Communications", Tata McGraw Hill, New Delhi, 2018.
2.Bernard Sklar , "Digital Communications- Fundamentals and applications", Pearson Education, New Delhi, 2009.
3.Reza F M , "An Introduction to information theory", McGraw Hill, New Delhi, 2010.
4.Sam Shanmugam K , "Digital and Analog communication systems", John Wiley Inc, Singapore, 2008.

19IE 603 VLSI DESIGN

3 0 0 3

INVERTERS : Review of MOS transistor equations -Passive load inverter- CMOS inverter – Transfer Characteristics, Power dissipation- Depletion mode and enhancement mode pull ups – Pseudo nMOS Inverter - Sheet resistance - Area Capacitance - Inverter delay and Logical Effort (9)

LOGIC DESIGN : Combinational logic circuits - Static CMOS logic: Complementary CMOS, Ratioed logic, Pass- Transistor, Transmission gate - Dynamic CMOS logic – Performance, Noise considerations, domino, npCMOS logic - Sequential logic circuits - static and dynamic flip-flops (10)

SUBSYSTEM DESIGN : Design of adders-Static adder, Mirror adder, Carry Look Ahead adder, Binary adder – MultipliersArray multiplier, Carry Save multiplier, Booths and Modified Booths multiplier - Barrel shifter, Logarithmic shifter (10)

MEMORY DESIGN : CAM memory,4x4 -OR ROM, NOR ROM, NAND ROM cell array,6-T SRAM cell,3-T DRAM cell, Memory peripheral circuitry-Address Decoders-Sense amplifiers-Power dissipation in memories (9)

VLSI LAYOUT DESIGN AND FABRICATION TECHNIQUES : Layout styles – Full custom and Semi custom approaches - Layout Design Rules – CMOS nwell process rules - Stick diagram - Layout examples – Fabrication techniques - Wafer processing - Oxidation - Patterning - Diffusion - Ion implantation - Deposition - CMOS processes : nWell, Twin tub, Silicon on Insulator (7)

Total L: 45

TEXT BOOKS:

1.Neil H E Weste , Kamran Eshranghian , "Principles of CMOS VLSI Design: A system Perspective", Addison Wesley, 2009.
2.Jan M Rabaey , Anantha Ch , "Digital Integrated Circuits- A Design Perspective", Prentice hall of India, 2016.

REFERENCES:

1.Caver Mead , Lynn Conway , "Introduction to VLSI Systems", Addison-Wesley, 1980.
2.Douglas A Pucknell , Kamran Eshranghian , "Basic VLSI Design", Prentice Hall of India, 2011.
3.Amar Mukherjee , "Introduction to nMOS and CMOS VLSI System Design", Prentice Hall, 1986.
4.Ajay Kumar Singh , "Digital VLSI Design", PHI Learning Private Limited, 2011.

19IE 604 EMBEDDED SYSTEMS AND IOT

3 1 0 4

INTRODUCTION : Characteristics of embedded systems - Design challenges - Design flow - Specifications and modeling - Design model - Product design life cycle - Wired and wireless communication protocols - I2C , SPI, CAN, BLUETOOTH, WiFi, ETHERNET (10+3)

ARCHITECTURE OF ARM CORTEX M4 MICRO CONTROLLER : General purpose I/O - System clock - Watch dog timer - Micro DMA - Low power modes - Interrupts (10+3)

PERIPHERAL INTERFACING : Timers - RTC - ADC - Analog comparator - DAC - Motion control peripherals - PWM, QEI - Interfacing : Display, Keyboard, stepper motor and DC motor (9+3)

REAL TIME OPERATING SYSTEMS : OS services - Process management - Scheduling Algorithms - RMA & EDF - Inter process communication techniques - Device driver - Interrupt handling (8+3)

IOT : Characteristics - Physical Design - Layered protocols - Logical design - Communication models - Enabling technologies - Cloud and APP facilities for IoT - Case study on IoT applications (8+3)

Total L: 45 + T: 15 = 60

TEXT BOOKS:

1.Bai Y , "Practical Micro Controller Engineering with ARM technology", John Wiley and Sons, 2015.
2.Bahga A, Madisetti V , "Internet of things : A Hands - on approach", University Press, Hyderabad, 2017.

REFERENCES:

1.Arnold s Berger , "Embedded systems Design: An introduction to Processes, tools and Techniques", CMP books, 2002.
2.TI Team , "Tiva TM4C123GH6PM Micro controller Data Sheet", .
3.RajKamal , "Embedded systems : architecture, programming and design", Tata McGraw Hill, 2011.
4.Marwedel P , "Embedded system Design", Springer, New York, 2006

19IE 605 DIGITAL IMAGE PROCESSING

3 0 0 3

DIGITAL IMAGE FUNDAMENTALS : Two dimensional signals and systems - Mathematical preliminaries, Image sensing and acquisition-CCD, CMOS, X-Ray, CT, MRI, Ultrasound, SAR, IR, Thermal-Imaging , Image processing system- Image formationSampling and Quantization - Neighbours of pixel – Distance measures, Color models (8)

IMAGE TRANSFORMS : Discrete Fourier transform - properties – Discrete Cosine Transform - Properties - KL Transform and SVD. (8)

IMAGE ENHANCEMENT : Point Operations - Histogram Equalization technique - Spatial Filtering – Low pass filtering, Median filtering , Sharpening Filters - frequency domain – Homomorphic filtering, Color Image enhancement. Case Study: Image enhancement, noise removal operations in an image. (10)

IMAGE COMPRESSION : Image Compressions models - Variable length coding - Bit plane coding –- Predictive coding – JPEG, MPEG-2 Case Study: JPEG image compression using DCT coding (9)

IMAGE SEGMENTATION AND REPRESENTATION : Discontinuity detection : Point, Line and Edge , Gradient operators , combined detection - Thresholding – Region based segmentation - Representation schemes: chain codes - Boundary descriptors: Simple, Shapes , Texture – Morphology : dilation and erosion, opening and closing. Case Study: Image Analysis: License plate detection, CT image analysis, crack detection, Missing component detection. (10)

Total L: 45

TEXT BOOKS:

1.Rafael C Gonzalez, Richard E Woods , "Digital Image Processing", 4th Edition, Pearson, India, 2018.
2.Jayaraman S, Esakkirajan S, Veerakumar T , "Digital Image Processing", 1st Edition, Tata McGraw Hill, New Delhi, 2009.

REFERENCES:

1.Anil K Jain , "Fundamentals of Digital Image Processing", Prentice Hall of India Pvt Ltd, New Delhi, 1995.
2.Rafael C Gonzalez, Richard E.woods, Steven L. Eddins , "Digital Image Processing Using MATLAB", Tata McGraw Hill, New Delhi, 2010.
3.Al.Bovik , "The Essential Guide to Image Processing", Academic Press, India, 2009.

19IE 610 DIGITAL SIGNAL PROCESSING LABORATORY

0 0 2 1

SOFTWARE EXPERIMENTS:

1) FFT Algorithms
2) Filtering of long data sequences
3) IIR filter design using bilinear transformation
4) FIR filter design using windows
5) Analysis of Finite word length effects (15)

HARDWARE EXPERIMENTS:

1) Signal generation
2) Arithmetic operations
3) Linear convolution
4) FIR filter
5) IIR filter (15)

Total P: 30

TEXT BOOKS:

1. Vinay K Ingle and John G Proakis , “Digital signal processing using MATLAB”, , Brooks / Cole, California, United States, 2011.

REFERENCES:

1. Mitra S K , "Digital Signal Processing – A Computer based Approach", Tata McGraw Hill, New Delhi, 2010.
2. Vinay K Ingle, John G Proakis , "Digital signal processing using MATLAB", United States, Brooks / Cole, California, 2011.

19IE 611 VLSI DESIGN LABORATORY

0 0 2 1

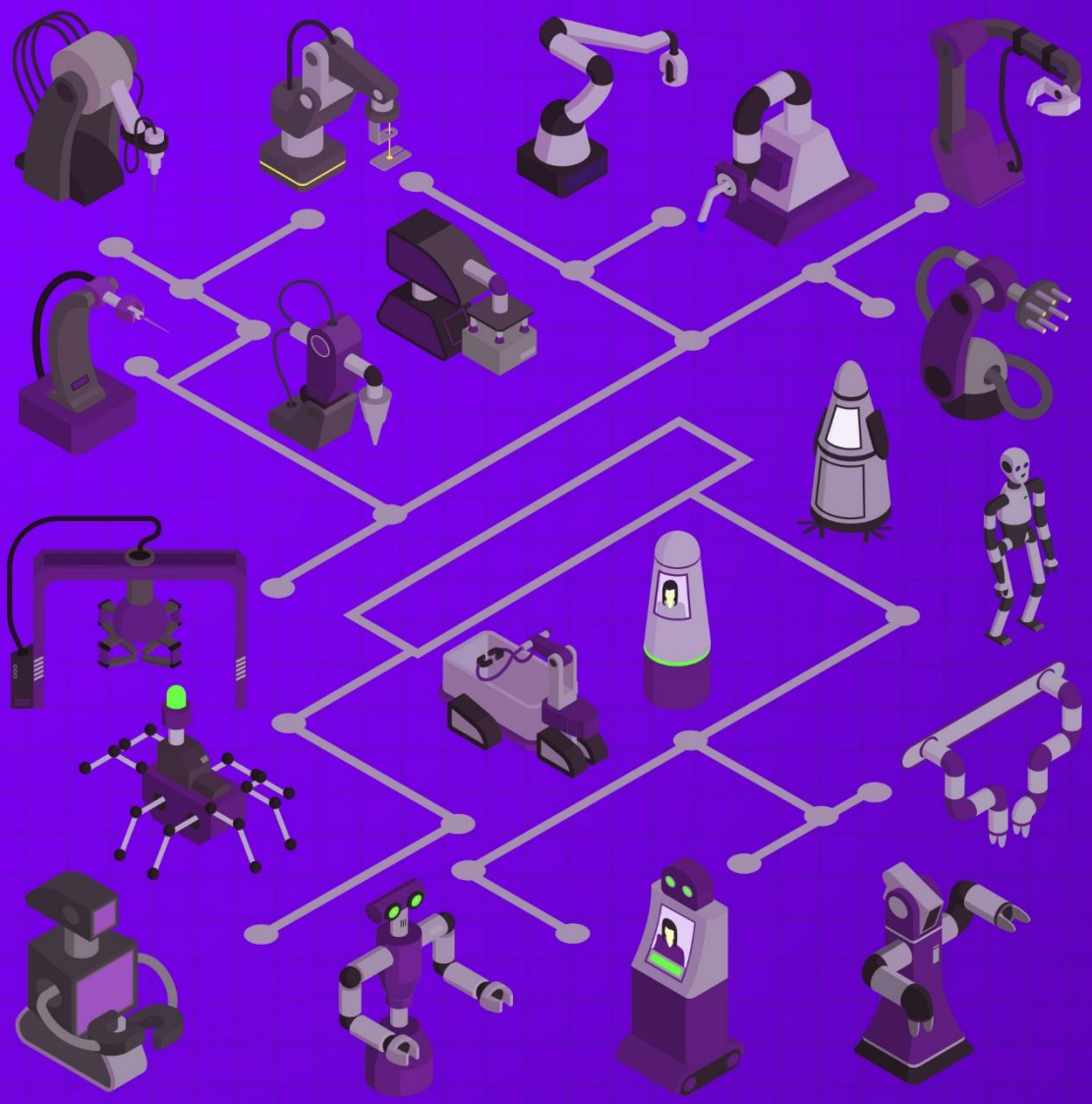
SOFTWARE EXPERIMENTS:

1. Characteristics of NMOS and PMOS transistors
2. Design and Simulation of nMOS inverter, CMOS inverter, Pseudo nMOS inverter and obtaining its Transfer characteristics, Noise Margin
3. Power analysis of nMOS inverter, CMOS inverter and Pseudo NMOS inverter
4. Design of combinational Static CMOS circuits - Complementary CMOS, Pass transistors, Transmission gates
5. Design of combinational Dynamic CMOS circuits –Domino, npCMOS logic
6. Design and Simulation of simple combinational and sequential circuits using CMOS gates (encoder, multiplexer, code converters, counters, registers)
7. Design and Simulation of static and dynamic flipflops – C2MOS, Pseudostatic, NORACMOS
8. Design and Simulation of subsystem modules-Adders, Multipliers
9. Layout design of Digital logic circuits (24)

HARDWARE EXPERIMENTS:

1) FPGA implementation of subsystem modules-Carry Look Ahead Adder, Multipliers (6)

Total P: 30



MECHATRONICS ENGINEERING

COURSES OF STUDY AND SCHEME OF ASSESSMENT

Course Code	Course Title	Periods / week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	FE	Total
SEMESTER I								
19IR 101	Calculus and its Applications	3	1	0	4	50	50	100
19IR 102	Physics	3	0	0	3	50	50	100
19IR 103	Applied Chemistry	3	0	0	3	50	50	100
19IR 104	Introduction to Mechanical Systems	3	0	0	3	50	50	100
19IR 105	English Language Proficiency	2	1	0	3	50	50	100
19IR 110	Engineering Graphics	0	0	4	2	100	-	100
19IR 111	Basic Sciences Laboratory	0	0	4	2	100	-	100
19IR 112	C Programming Laboratory	0	0	4	2	100	-	100
19IH 071	Indian Language	2	1	0	3	50	50	100
19IG 065	German Language – A1	12	0	0	4	-	100#	100
SEMESTER 2								
19IR 201	Complex Variables and Transforms	3	1	0	4	50	50	100
19IR 202	Materials Science	2	0	0	2	50	50	100
19IR 203	Electrical Circuit Theory	3	1	0	4	50	50	100
19IR 204	Strength of Materials	3	0	0	3	50	50	100
19IR 205	Manufacturing Technology	3	0	0	3	50	50	100
19IR 210	Electric Circuits and Networks Laboratory	0	0	4	2	100	-	100
19IR 211	Engineering Practices	0	0	4	2	100	-	100
19IR 214	Professional Skills	6	0	9	2	50	50	100
19IR 215	Internship – Summer Training	6	0	9	2	50	50	100
19IG 066	German Language – A2	12	0	0	4	-	100#	100
19IH 072	American History	2	1	0	3	100	-	100
SEMESTER 3								
19IR 301	Linear Algebra and Numerical Analysis	3	1	0	4	50	50	100
19IR 302	Analog Electronics	3	0	0	3	50	50	100
19IR 303	Electrical Machines and Power systems	3	0	0	3	50	50	100
19IR 304	Theory of Machines	3	0	0	3	50	50	100
19IR 305	Data Structures and Algorithms	2	2	0	4	50	50	100
19IR 306	Economics for Engineers	3	0	0	3	50	50	100
19IR 310	Analog Electronics Laboratory	0	0	2	1	100	0	100
19IR 311	Mechanics and Machines Laboratory	0	0	2	1	100	0	100
19IK 312	Environmental Science	2	0	0	0	-	-	-
19IG 067	German Language – B1.1	12	0	0	4	-	100	100
19IH 073	Organizational Behavior	3	0	3	3	50	50	100

SEMESTER 4								
19IR 401	Probability and Statistics	2	1	0	3	50	50	100
19IR 402	Automatic Control Systems	3	1	0	4	50	50	100
19IR 403	Basics of Robotics	3	0	0	3	50	50	100
19IR 404	Digital Electronics	3	0	0	3	50	50	100
19IR 405	Hydraulics and Pneumatics	3	0	0	3	50	50	100
19IR 406	PLC and SCADA	3	0	0	3	50	50	100
19IR 410	Digital and Control Systems Laboratory	0	0	2	1	100	0	100
19IR 411	Hydraulics and Pneumatics Laboratory	0	0	2	1	100	0	100
19IR 412	PLC and SCADA Laboratory	0	0	4	2	100	0	100
19IQ 413	Soft Skills Development	0	0	2	1	100	0	100
19IG 068	German Language – B1.2	12	0	0	4	-	100	100
19IH 074	TOEFL / IELTS Training	6	0	9	2	50	50	100
SEMESTER 5								
19IR 501	CNC Machines	3	0	0	3	50	50	100
19IR 502	Dynamics and Control of Manipulators	2	1	0	3	50	50	100
19IR 503	Microprocessors and Microcontrollers	3	0	0	3	50	50	100
19IR 504	Design of Mechanical Transmission Systems	2	1	0	3	50	50	100
19IR 510	CNC and CAD Laboratory	0	0	4	2	100	0	100
19IR 511	Microprocessors and Microcontrollers Laboratory	0	0	2	1	100	0	100
19IR 512	Robotics Laboratory	0	0	2	1	100	0	100
19IG 069	German Language – B2	12	0	0	4	-	100	100
SEMESTER 6								
19IR 601	Power Electronics and Drives	3	0	0	3	50	50	100
19IR 602	Automation System Design	2	1	0	3	50	50	100
19IR 603	AI for Robotics	3	1	0	4	50	50	100
19IR 604	Vision Systems	3	0	0	3	50	50	100
19IR 605	Sensors and Instrumentation	3	0	0	3	50	50	100
19IR 610	Power Electronics and Drives Laboratory	0	0	4	2	100	-	100
19IR 611	AI and Vision Systems Laboratory	0	0	4	2	100	-	100
19IG 070	German Language – C1	12	0	0	4	-	100	100

DETAILED SYLLABI

SEMESTER - 1

19IR 101 CALCULUS AND ITS APPLICATIONS

3 1 0 4

DIFFERENTIAL CALCULUS: Functions of two variables, limit, continuity, partial derivatives, differentiability, total differential, extreme values and saddle points, constrained maxima and minima, Lagrange multipliers with single constraint, Taylor's formula for two variables.

(9 +3)

MULTIPLE INTEGRALS I: Basic concepts, double integrals over rectangles, double integrals as volumes, Fubini"s theorem, double integrals over general regions, area by double integration, reversing the order of integration.

(9 +3)

MULTIPLE INTEGRALS II: Double integrals in polar form, triple integrals in rectangular coordinates, spherical and cylindrical coordinates. (9 +3)

SECOND ORDER LINEAR ORDINARY DIFFERENTIAL EQUATIONS: Homogeneous linear ODEs of second order, linearity principle, general solution, homogeneous linear ODEs with constant coefficients, Euler–Cauchy equations, solution by variation of parameters, modeling of electric circuits. (9 +3)

VECTOR CALCULUS: Gradient of a scalar field, directional derivative, divergence of a vector field, curl of a vector field. Integration in vector field – line integrals, Green's, Gauss divergence and Stokes's theorems.

(9 + 3)

Total L: 45 +T: 15 =60

TEXT BOOKS:

1. Joel Hass, Christopher Heil, Maurice D. Weir "Thomas' Calculus", Pearson Education., New Delhi, 2018.
2. Erwin Kreyszig "Advanced Engineering Mathematics", Wiley India Pvt Ltd., New Delhi, 2015.

REFERENCES:

1. J.E.Marsden, A.J.Tromba, A. Weinstein "Basic Multivariable Calculus", Springer Verlag., New York, 2019.
2. Howard Anton, Irl Bivens, Stephen Davis "Calculus",John Wiley &Sons, INC., USA, 2016.
3. Wylie C R and Barrett L C "Advanced Engineering Mathematics", Tata McGraw-Hill., New Delhi, 2019.
4. James Stewart "Multivariable Calculus", Brooks Cole., USA, 2012.

19IR 102 PHYSICS

3 0 0 3

MECHANICS: Review of Vector quantities Inertial mass, Newton's third law and Free Body diagrams. Rigid body dynamics: Centre of mass. Moment of inertia. Torque, angular momentum and angular acceleration. Work, power and energy. Conservation of momentum. Conservation of energy. Elastic and inelastic collisions. Kinetic energy considerations. Circular motion: Radial and tangential forces. Centripetal acceleration and centripetal force.

(10)

OSCILLATORY MOTION: Simple harmonic motion. Velocity damping. Damping coefficient. Differential equation of SHM. Velocity and acceleration. Restoring force. Vibration of a spring and mass system. Frequency response, phase response and resonance. Analogy with LCR circuits. Energy and energy loss. Vibration and vibration isolation.

(8)

WAVE MOTION: Definition of a plane progressive wave. Attenuation of waves. Representation of waves using complex numbers. Differential equation of a plane progressive wave. Phase velocity. Phase and phase difference. Solution of the differential equation of a plane progressive wave. Differential equation of 2-dimensional wave motion. Introduction to numerical methods for solution of wave equation.

(8)

OPTICS:I mage formation using lenses and mirrors. Spherical and chromatic aberration. Methods of reducing aberrations. Aspherical components, aperture control, multiple elements. Adaptive optics. Definition of depth of field. Fresnel mirrors. Fresnel mirrors for solar energy. Tracking of Fresnel mirrors. Illumination. Principles of photometry and definition of fundamental photometric quantities. Interference and diffraction. Single and double slits. Interpretation of the energy distribution equation in single and double slit patterns (no derivations). Principle of Fabry - Perot interferometer. Principle of Michelson's interferometer. Applications. Spectral distribution: emission and absorption spectra. Examples.

(9)

ELECTROMAGNETISM: Magnetic effects of electric current. Magnetic fields. Definition of fundamental terms. Permeability. Forces due to currents. Uniform and non-uniform magnetic fields. Static and time-varying magnetic fields. Electromagnetic induction. Expression for induced emf. Electric fields; definition of fundamental terms. Dielectric polarization. Dielectric constant. Permittivity. Gauss theorem. Electromagnetic waves. Propagation of electromagnetic waves through isotropic media. Maxwell's equations and interpretation of Maxwell's equations.

(10)

Total L: 45

TEXT BOOKS:

1. Richard Wolfson "Essential University Physics", 3rd Edition, Pearson Education., Singapore, 2016.
2. Ghatak "Optics", 6th Edition, Tata McGraw-Hill., 2017.

REFERENCES:

1. Avadhanulu, M.N "Engineering Physics", S. Chand & Co., 2010.
2. Purcell, E.M "Electricity and Magnetism – Berkeley Physics Course", Tata McGraw-Hill., 2017.
3. F.S.Crawford "Waves", Berkeley Physics Course, 2008.
4. Paul A Tipler and Geene Mosca "Physics for Scientists and Engineers", 6th Edition, W.H.Freeman and Company., New York, 2007.

19IR 103 APPLIED CHEMISTRY

3 0 0 3

METALS AND ALLOYS: Phase rule-influence of alloying on properties-Pb/Ag and Cu/Ni systems-applications, Fe- C system. Applications of aluminum and titanium alloys. Modification of metallic surfaces-electroplating of copper, nickel and chromium, electroless plating of nickel and copper, electro polishing and electrochemical machining.

(9)

POLYMERS: Polymers -classification, degree of polymerization, mechanisms- chain and condensation polymerization, average molecular weights, polydispersity. Properties - amorphous and crystalline states – structural features influencing crystallinity, thermal properties - glass transition temperature (Tg) – factors affecting Tg, mechanical properties, electrical properties.

Polymer composites – matrix materials, fibres - carbon, glass, aramid, properties and applications. Conducting polymers-mechanism of charge transport, applications in LED's, photovoltaics.

(9)

CORROSION AND PROTECTIVE COATINGS: Chemistry of corrosion – Electrochemical cells– electrode potential, Nernst equation, emf and galvanic series. Forms of corrosion - galvanic, differential aeration, stress corrosion cracking, erosion, fretting, corrosion fatigue, tribocorrosion. Corrosion rate - factors influencing corrosion. Protective coatings- conversion coatings- anodizing, phosphating, chromating, organic coatings-paints-types and applications, superhydrophobic and self- healing coatings.

(9)

ELECTROCHEMICAL POWER SOURCES: Batteries- characteristics-construction and working of lechlanche, lead- acid, nickel-cadmium and lithium ion batteries. Advanced batteries and supercapacitors. Fuel cells- working principle and applications of proton exchange membrane, direct methanol and solid oxide fuel cells. Hydrogen as a fuel-production and storage.

(9)

MISCELLANEOUS MATERIALS: Water- quality parameters, methods of determination of hardness, TDS, conductivity, purification-ion exchange, membrane filtration, sensors for water quality monitoring- pH, flame photometry, photo colorimeter, ICP-MS. Lubricants-classification, properties, mechanism of lubrication- additives and improvers. High temperature materials: refractories-types, uses, ceramics-electro ceramics and uses. Adhesives and sealants.

(9)

Total L: 45

TEXT BOOKS:

1. Shashi Chawla "A Text Book of Engineering Chemistry", Dhanpat Rai& Co., New Delhi, 2005.
2. SS Dara, SS Umare "A Textbook of Engineering Chemistry", 20th Edition, S Chand & Co., New Delhi, 2010.

REFERENCES:

1. Sharma B. K "Engineering Chemistry", Krishna Prakashan Media (P) Ltd., Meerut, India, 2005.
2. Mary Jane Shultz "Engineering Chemistry", Cengage learning, USA, 2009.
3. Jain P C, Jain M "Engineering Chemistry", Dhanpat Rai Publishing Company., New Delhi, 2005.

19IR 104 INTRODUCTION TO MECHANICAL SYSTEMS

3 0 03

STATICS OF PARTICLES: Introduction – Units and Dimensions – Laws of Mechanics – Force-Characteristics - System of forces - Lami's theorem, Parallelogram and triangular Law of forces, Statics of rigid bodies in two dimensions, force couple system.

(7)

EQUILIBRIUM OF RIGID BODIES: Free body diagram – Types of supports –Action and reaction forces - Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Varignon"s theorem – Equilibrium of Rigid bodies in two dimensions.

(8)

PROPERTIES OF SURFACES AND SOLIDS: Centroids and centre of mass – Area moments of inertia of plane areas – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia- Mass moment of inertia – Comparison of Mass moment of Inertia and Area Moment of Inertia.

(11)

RIGID BODY DYNAMICS: Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion- Newton‟s laws of motion – Work Energy Equation. Friction force – Laws of sliding friction –equilibrium analysis of simple systems with sliding friction

(11)

INTRODUCTION TO ROBOTS: Robotics - Law of robotics – Anatomy – Configuration of robots – free body diagram of robot configuration and force analysis.

(8)

Total L:45

TEXT BOOKS:

1. Beer F.P, Johnston Jr.E.R "Vector Mechanics for Engineers Statics and Dynamics", 11th Edition, McGraw Hill Education, 2017.
2. Mikell P Groover, Mitchell Weiss, Roger N Nagel, Nicholas Odrey, Ashish Dutta "Industrial Robotics (SIE): Technology, Programming and Applications", McGraw Hill Education India., 2012

REFERENCES:

1. Hibbeller R.C, Ashok Gupta "Engineering Mechanics Statics and Dynamics", 11th Edition, Pearson Education., 2009.
2. Bhavikatti S.S "Engineering Mechanics", 7th Edition, New Age International (P) Limited Publishers, 2019.
3. Young D H, Timashenko S "Engineering Mechanics", Tata McGraw-Hill., 2006
4. S K Saha "Introduction to Robotics", 2nd Edition, McGraw Hill Education India, 2014.

19IR 105 ENGLISH LANGUAGE PROFICIENCY

2 1 0 3

LEARNING LANGUAGE THROUGH STANDARD LITERARY AND GENERAL TEXTS: Integrated tasks focusing on language skills; Training based on Text based vocabulary, tone, register and Syntax features.

(12 + 0)

GRAMMAR IN CONTEXT: Word Order; Subject Verb Concord; Style features - Tenses, Conditionals, Prepositions, Active and Passive Voice, Modals, Cloze and Spotting Error exercises.

(10 + 0)

GUIDELINES FOR WRITTEN COMMUNICATION: Principles of clear writing, Paragraph writing, Essay writing, Emphasis Techniques, Summarizing and Paraphrasing, Analytical writing.

(8 + 0)

FOCUS ON SPOKEN ENGLISH : Task – based activities: Graded levels of difficulty and with focus on language functions - Level 1: Self – expression – Greetings in Conversation, Hobbies, Special interests, Daily routine - Level 2: General Awareness – Expression of Concepts, Opinions, Social Issues, Description of a process / picture/chart, news presentation / review - Level 3: Advanced Skills – Making Short Speeches and Participating in Role Plays.

(0 + 10)

LISTENING ACTIVITY: Task based activities using Language Laboratory. (0 + 5)

Total L: 30 +T: 15 =45

TEXT BOOK:

1. Faculty In-charge "Course Material on "English Language Proficiency", PSG College of Technology., Coimbatore, 2019

REFERENCES:

1. Jill Singleton "Writers at Work: The Paragraph", Cambridge University Press., New York, 2012.
2. Simon Haines, Mark Nettle and Martin Hewings "Advanced Grammar in Use", Cambridge University Press, New Delhi, 2008.
3. Anne Laws "Writing Skills", Orient Black Swan, Hyderabad, 2011.
4. Sinha DK "Specimens of English Prose", Orient Black Swan, Hyderabad, 2012.

19IR 110 ENGINEERING GRAPHICS

0 0 4 2

INTRODUCTION:

1) Introduction to Engineering Drawing, BIS, Principles of dimensioning
2) Geometric constructions
3) Curves –Conic section, Cycloids and Involutes. (10)

ORTHOGRAPHIC PROJECTION:

1) Principles of orthographic projection-projection of points
2) projection of straight lines
3) projection of planes and solids
4) Orthographic projection of simple engineering components. (15)

SECTION AND DEVELOPMENT OF SOLIDS:

1) Introduction to Sections of solids – Prisms, pyramids, cylinder and cone
2) Introduction to development of Surfaces - Prisms, pyramids, cylinder and cone. (10)

PICTORIAL PROJECTIONS:

1) Principles of pictorial views, isometric view of simple mechanical and robotic engineering components.
2) Orthographic views from given pictorial views
3) Isometric views from given two or three views. (10)

COMPUTER AIDED DRAFTING:

1) Introduction to engineering graphics CAD tools
2) Drawing Orthographic views from Isometric views using CAD tools (15)

Total P: 60

REFERENCES:

1. Venugopal K, Prabhu Raja V "Engineering Graphics", New Age International Publishers, 2017.
2. Department of Robotics and Automation Engineering "Engineering Graphics Manual", 2019.

19IR 111 BASIC SCIENCES LABORATORY

0 0 4 2

PHYSICS LIST OF EXPERIMENTS (ANY EIGHT):

1) Determination of Young"s Modulus of a wooden bar–Cantilever method
2) Determination of fibre thickness–air wedge method
3) Determination of wavelength of mercury spectrum using transmission grating
4) Measurement of vibration frequency of electrically maintained tuning fork using Melde"s apparatus
5) Determination of velocity of sound–Helmholtz resonator
6) Determination of Hysteresis loss of a ferromagnetic material
7) DeterminationofTemperatureCoefficientofResistanceofmetallicwireusingpostofficebox
8) Determinationofthermalconductivityofametallicmaterialusing Wiedemann–Franzlaw
9) Study of reverse bias characteristics of Germanium diode and determination of its band gap
10) Thermistor: Measurement of temperature and band gap (30)

CHEMISTRY (ANY EIGHT EXPERIMENTS):

1) Electroplating of nickel &copper and determination of cathode efficiency
2) Anodizing of aluminium and determination of thickness of anodized film
3) Determination of molecular weight of polymers by Ostwald / Ubbelohde Viscometer
4) Examination of different forms of corrosion using Ferroxyl indicator and determination of corrosion rate by current measurement
5) Conductometric estimation of acid strength of a pickling bath
6) Preparation of chloride ion sensor by anodizing silver and calibration
7) Determination of hardness, TDS, pH and conductivity of awater sample
8) Potentiometric estimation of ferrous ion in an effluent
9) Estimation of ferric ion in a water sample by photocolorimetry
10) Determination of kinematic viscosity of lubricating oil using Redwood/ Saybolt viscometer (30)

Total P: 60

REFERENCES:

1. Department of Chemistry "Chemistry Laboratory Manual", 2019.
2. Department of Physics "Physics Practicals", 2019.
3. Wilson J. D. and Hernandez C. A. "Physics Laboratory Experiments", 7th Edition, Houghton Miffin Company., New York, 2009.

19IR 112 C PROGRAMMING LABORATORY

0 0 4 2

1) Working with RAPTOR Tool – Flowchart Interpreter
2) Simple programs to understand Operators and expressions.
3) Decision making Statements: simple if, if..else, nested if .. else,elseifladder, switch case
4) Loops: while, do..while, for
5) Implementation of one-dimensional array
6) Implementation of two-dimensional array
7) Working with Strings
8) Functions
9) Recursive functions
10) Structures: Arrays and Structures, Nested Structures
11) Structures and functions
12) Implementation of pointer and pointer arithmetic
13) Types of pointer:const pointer, pointer to a constant, void pointer, null pointer (60)

Total P: 60

REFERENCES:

1. Deitel H. M. and Deitel P. J "C: How To Program", Prentice Hall of India., New Delhi, 2015

SEMESTER - 2

19IR 201 COMPLEX VARIABLES AND TRANSFORMS

3 1 0 4

COMPLEX DIFFERENTIATION: Complex differentiation - analytic function, Cauchy-Riemann equations, harmonic functions, linear fractional transformations. (9+3)

COMPLEX INTEGRATION: Cauchy"s integral theorem, Cauchy"s integral formula, Laurent series, singularities and zeros, residue integration method (Residue integration of complex integrals only). (9+3)

LAPLACE TRANSFORMS: Laplace transform, inverse transform, linearity, s-shifting, transforms of derivatives and integrals, unit step function, t - shifting, Dirac"s delta function, periodic functions, method of solving differential equations by using Laplace transform technique. (9+ 3)

FOURIER SERIES: Fourier series- convergence and sum of Fourier series, functions of any period 2L, even and odd functions, half range expansions. (9 + 3)

FOURIER TRANSFORMS: Fourier transform, Fourier cosine and sine transforms, Discrete Fourier transform, Fast Fourier transform – DIT algorithm. (9+ 3)

Total L: 45 +T: 15 =60

TEXT BOOKS:

1. Erwin Kreyszig "Advanced Engineering Mathematics", John Wiley &Sons., New Delhi, 2015.
2. Wylie C. R. and Barrett L. C "Advanced Engineering Mathematics", Tata McGraw-Hill., New Delhi, 2019.

REFERENCES:

1. Mathews J. H. and Howell R. W "Complex Analysis for Mathematics and Engineering", Narosa Publishing House., New Delhi, 2012.
2. Peter V.O Neil "Advanced Engineering Mathematics", Cengage., New Delhi, 2016.
3. Dennis G Zill "Advanced Engineering Mathematics", Jones & Bartlett India Pvt Ltd., New Delhi, 2017.
4. Dean G Duffy "Advanced Engineering Mathematics with MATLAB", CRC., USA, 2017.

19IR 202 MATERIALS SCIENCE

2 0 0 2

QUANTUM MECHANICS: Wave particle duality, de Broglie waves- Heisenberg's uncertainty principle. Wave function- normalization. The wave equation. Schrodinger's equation of motion: Time dependent form, steady-state form. Particle in a box. Quantum Tunneling and applications to Scanning Tunneling Microscope and Tunnel diode

(8)

ELECTRICAL PROPERTIES: Conducting materials-quantum free electron theory -Fermi Dirac Statistics-Band theory of solids-the density of states. Dielectrics-types of polarization-measurement of dielectric permittivity-Loss Factor-Dielectric loss mechanisms. Magnetostriction. Electron ballistics- materials for thermionic

(7)

PHYSICS OF SEMICONDUCTORS: P type and N type semiconductors-the effective mass. Free electron and hole concentration in semiconductors. Band gap determination. Carrier concentration in n and p type semiconductor. P- N junction, rectifier equation -Hall effect-Quantum tunneling. Hetero junction-Quantum well, wire, dots-Optical properties of Semiconductors: LD, LED, Photo diode. Introduction to MEMS (8)

MAGNETIC PROPERTIES: Types of magnetic materials-domain theory-hysteresis- hard and soft magnetic materials- Applications-eddy current brakes, regenerative braking. Magnetic lenses. Superconductivity –Meissners effect- Josephson junction, SQUID magnetometer, applications. (7)

Total L: 30

TEXT BOOKS:

1. William D Callister Jr "Materials Science and Engineering - An Introduction", 6th Edition, John Wiley and Sons Inc., New York, 2007.
2. Arthur Beiser "Concepts of Modern Physics", Tata McGraw Hill., India, 2002.

REFERENCES:

1. James F Shackelford S "Introduction to Materials Science for Engineers", 3rd Edition, Macmillan Publishing Company., India, 1992.
2. Van Vleck "Elements of Material Science and Engineering", Pearson Education., India, 2008
3. Sze S.M "Physics of Semiconductor Devices", John Wiley and Sons., USA, 2007
4. Donald R Askeland, Wendelin J Wright "Essentials of Materials Science and Engineering", 3rd Edition, Cengage Learning., USA, 2013.

19IR 203 ELECTRICAL CIRCUIT THEORY

3 1 0 4

INTRODUCTION: Ohm"s law - Resistors, Capacitors and Inductors - Series and Parallel Combination circuit - Magnetically coupled circuit - Illustration of dot conventions - Sources - Introduction to Dependent Sources - Kirchhoff's Laws - Source Transformation - Star Delta Transformation - Mesh Analysis - Super mesh analysis -Nodal Analysis – Super node Analysis. (12 +4)

NETWORK THEOREMS: Superposition theorem - Thevenin's theorem - Norton's theorem – Maximum power transfer theorem. (8 +3)

SINGLE PHASE AC CIRCUITS : Introduction to Alternating Quantities - Terms Related to Alternating Quantity - Average and RMS values - Phasor Representation of Alternating Quantities - Mathematical representation of Phasor - Behavior of Pure Resistor, Pure Inductor and Pure Capacitor in an AC circuit - Series RL circuit – Series RC circuit - Series RLC circuit - Parallel and Series circuit - Real power, Reactive power, Apparent power, Complex power - Introduction to Resonance in parallel and series circuits. (10+3)

THREE PHASE CIRCUIT ANALYSIS: Introduction - Advantages of Three Phase System - Interconnection of three phases Star and Delta connection - Voltage, Current and Power Relations in Balanced Star and Delta connected Load - Comparison between Star and Delta connection - Introduction to Three Phase Circuit analysis with star and delta unbalanced loads -Measurement of Three Phase Power. (10 +3)

TRANSIENT ANALYSIS OF FIRST AND SECOND ORDER LINEAR CIRCUITS: Transient Concepts - Transient response of Simple RL, RC and RLC Circuits - Solution of RL, R C and RLC Circuits for Step Input and Sinusoidal Excitations using Laplace Transform method. (5 +2)

Total L: 45 +T: 15 =60

TEXT BOOKS:

1. Charles K Alexander and Mathew N O Sadiku "Fundamentals of Electric Circuits", Tata McGraw Hill., 2013
2. William H. Hayt, Jr., Jack E. Kemmerly and Steven M. Durbin "Engineering Circuit Analysis", Tata McGraw Hill., 2013

REFERENCES:

1. Ravish R Singh "Electrical Networks", Tata McGraw Hill., New Delhi, 2017.
2. Joseph A Edminister and Mahmood Nahvi "Electric Circuits", Tata McGraw Hill., 2013.
3. Richad C Dorf and James A Svoboda "Introduction to Electric Circuits", John Wiley and Sons Inc.., 2013.
4. David A Bell "Electric Circuits", PHI Pvt. Ltd., 2009.

19IR 204 STRENGTH OF MATERIALS

3 0 0 3

STRESSES AND STRAINS: Stress and strain due to axial force, elastic limit, Hooke's law-factor of safety – stepped bars, uniformly varying sections, stresses in composite bar due to axial force and temperature. (8)

CHANGES IN DIMENSIONS AND VOLUME: Lateral strain -Poisson's ratio, volumetric strain, changes in dimensions and volume, shear stress, shear strain, relationship between elastic constants. (8)

PRINCIPAL STRESSES AND STRAINS: (Two dimensional only) State of stress at a point - normal and tangential stresses on a given plane, principal stresses and their planes, plane of maximum shear stress -Mohr's circle method, application to simple problems. (7)

BEAMS: Relationship between load, shear force and bending moment - shear force and bending moment diagrams for cantilever, simply supported and overhanging beams under concentrated loads, uniformly distributed loads, uniformly varying loads, concentrated moments, maximum bending moment and point of contra flexure. Theory of simple bending and assumptions - derivation of equation, section modulus, normal stresses due to flexure. (15)

TORSION: Theory of torsion and assumptions-derivation of the equation, polar modulus, stresses in solid and hollow circular shafts, power transmitted by a shaft (7)

Total L: 45

TEXT BOOKS:

1. Punmia B C, Ashok Kumar Jain, Arun Kumar Jain "Mechanics of materials", Laxmi Publications., New Delhi, 2017.
2. Hibbeler R C "Mechanics of Materials", 9th Edition, Pearson Education., 2018.

REFERENCES:

1. Ramamrutham S, Narayan R "Strength of Materials", Dhanpat Rai and Sons, New Delhi, 2018.
2. Egor P Popov "Engineering Mechanics of Solids", 2nd Edition, Pearson Education., 2015.
3. Gere &Timoshenko "Strength of Materials", 2nd Edition, CBS Publisher, 2006.
4. Don H Morris, William F Riley, Leroy D Sturges "Mechanics of Materials", John Wiley and Sons Inc., 2007.

19IR 205 MANUFACTURING TECHNOLOGY

3 0 03

METAL CASTING: Foundry –Pattern layouts – Parting lines – Mould and Core making –Melting: Types of furnace- Casting Processes –Sand casting - Shell, Investment casting – Pressure die casting – Centrifugal casting. Case Study: Mould preparation and casting for a specified robot part. (9)

METALFORMING AND WELDING: Forging - Extrusion - Injection moulding – Compression moulding. Sheet metal forming process. Welding – Metal inert gas (MIG) welding, Tungsten Inert Gas (TIG) welding and Shielded metal arc welding (SMAW). Case Study: Robotic welding. (9)

METAL CUTTING FOR CYLINDRICAL COMPONENT: Theory of metal cutting – Types of Lathe – Specifications - Lathe operations - Facing – Turning – Taper turning – Grooving – Boring – Drilling – Cutting off/Parting off – Threading – Knurling – Profiling and Forming process. Case Study: Machining process using Lathe for a specified robot part. (9)

METAL CUTTING FOR PRISMATIC COMPONENT: Introduction to special machines - Shaping – Planing – Slotting – Milling, Drilling, Boring, Grinding and Broaching process. Case Study: Machining process using Special machines for specified robot part. (9)

NON-CONVENTIONAL MACHINING PROCESS: Electrical Discharge Machining (EDM) – Wire cut EDM – Laser Jet Machining – Water Jet Machining and Electron Beam Machining (EBM). Case Study: Development of a specified robot component. (9)

Total L: 45

TEXT BOOKS:

1. P. N. Rao "Manufacturing Technology vol I", Tata-McGraw-Hill Publishing Limited., 2010.
2. HMT- ""Production Technology"", McGraw-Hill Education, 2014.

REFERENCES:

1. Ghosh A, Mallik A.K "Manufacturing Science", Affiliated East west Press Ltd., 2001.
2. Serope Kalpakjian "Manufacturing Engineering and Technology", 4th Edition, Pearson India., 2014.
3. Hajra Choudhury "Elements of Workshop Technology, Vol. I &II", Media Promotors Pvt. Ltd., 2009.
4. Radhakrishnan "Manufacturing Technology I", SciTech Publications Pvt. Ltd., 2010.

19IR 210 ELECTRIC CIRCUITS AND NETWORKS LABORATORY

0 0 4 2

1) Study of materials used for conducting wires, Wire-gauge measurement and Industrial standards for insulators and cables.
2) Experimental verifications using Resistors, Inductors and Capacitors: Series - Parallel combination of resistors, inductors and capacitors; Resistors use in Current limiting circuits, Voltage division and Wheatstone bridge; Capacitors use in Filtering
3) Verification of Ohm's, Kirchhoff's laws and Series - Parallel combination of DC Sources – Circulating current.
4) Verification of Thevenin's theorem and Norton's Theorem
5) Verification of Superposition theorem and Maximum power transfer theorem.
6) Measurement of Power factor in RL and RC Circuit.
7) Series and Parallel resonance circuits.
8) Three phase power measurement by two wattmeter method in balanced and unbalanced loads
9) DC and AC circuit analysis using Pspice.

10) Transient analysis of RL, RC and RLC circuit using Pspice and experimental verification. (60)

Total P: 60

REFERENCE:

1. Department of Robotics and Automation Engineering "Electric Circuits and Networks Laboratory Manual", 2019.

19IR 211 ENGINEERING PRACTICES

0 0 4 2

ELECTRICAL:

1) Measurements and operations using CRO, DSO, Function Generator and RPS.
2) Soldering, de-soldering and crimping practices.
3) Study and practice of electrical wiring for two-way, three phase selector and fluorescent lamp.
4) Study of single and three phase power system in domestic applications.
5) Measurement of electrical parameters using hand held devices.

(26)

MECHANICAL:

1) Welding: Tools, operations and types of joints - Exercises to make “Lapp”, “Butt” and “T” joints.
2) Fitting: Tools, operations and types of joints - Exercises to make “T” and “L” Joints.
3) Sheet metal work: Tools and operations - Exercises to make tray and cone.
4) Lathe: Tools and Holding devices - Exercises on Facing, Turning and Drilling operations.
5) Drilling: Tools and Holding devices - Exercises on Drilling, Reaming and Tapping operations
6) Plumbing: Tools, operations and types of joints

(34)

Total P: 60

REFERENCE:

1. Department of Robotics and Automation Engineering "Engineering Practices Laboratory manual", 1st Edition, PSG CT., Coimbatore, 2019.

19IR 213 INTERNSHIP

0 0 0 2

ROBOTIC KITS: Study of robot components and types of robots.

ROBOT ASSEMBLING AND PROGRAMMING: Assembly and programming of robots -Lego, Vex and Tetrix Kits - Five- minute bot using NXT software, Robot C and ROS platform, Line follower, Obstacle avoidance robot, Wall following robot, robot arm and other simple applications.

e-YANTRA FIREBIRD KIT: Introduction, Architecture, programming using Atmel studio, Programming: Buzzer, Line following, LCD display and other simple applications.

1) Visit to PSG Heavy Engineering Division.
2) Visit to PSG- Fanuc Centre for Advanced CNC &Robotics.
3) Visit to TIFAC – CORE.
4) Visit to PSG foundry division.
5) Visit to PSG-DHI CoE in Welding Engineering and Technology

Total P: 40

SEMESTER - 3

19IR 301 LINEAR ALGEBRA AND NUMERICAL ANALYSIS

3 1 0 4

VECTOR SPACE : General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension. (9+3)

SYSTEM OF LINEAR EQUATIONS, EIGENVALUES AND EIGENVECTORS : Errors - approximations and round-off errors—truncation errors, system of linear equations- Naive Gauss elimination method, Crout's method, Gauss– Seidel method, eigenvalues and eigenvectors using power method . (9+3)

INTERPOLATION, DIFFERENTIATION AND INTEGRATION : Newton„s divided-difference interpolating polynomials, Lagrange interpolating polynomials, equally space data-Newton„s forward and backward interpolating polynomials, numerical differentiation–evenly spaced data, numerical integration - Newton-cotes formulae, trapezoidal rule, Simpson„s 1/3 rule. (9+3)

NUMERICAL SOLUTION TO ORDINARY DIFFERENTIAL EQUATIONS : Numerical methods for initial value problem, Taylor- series, Euler"s method, modified Euler"s method, Runge-Kutta method of 4th order, multi step methods - Milne method. (9+ 3)

NUMERICAL SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS : Finite difference: elliptic equations - the Laplace equation, Poisson equation–Liebmann method, parabolic equations–heat conduction equation–Crank Nicolson„s method, hyperbolic equations – vibrating string. (9+3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Howard Anton and Chris Rorres, "Elementary Linear Algebra", Wiley India, New Delhi, 2018.
2. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers", Tata McGraw Hill, New Delhi, 2017.

REFERENCES:

1. David C Lay, "Linear Algebra and its Applications", Pearson, New Delhi, 2016.
2. Curtis F Gerald and Patrick O Wheatly, "Applied Numerical Analysis", Pearson, New Delhi, 2017.
3. Richard L Burden and Douglas J Faires, "Numerical Analysis", Thomas Learning, New York, 2017.
4. Ward Cheney and David Kincaid, "Numerical Mathematics and Computing", Cengage Learning, USA, 2018.

19IR 302 ANALOG ELECTRONICS

3 0 0 3

SEMICONDUCTOR PHYSICS AND DIODE THEORY : Intrinsic and Extrinsic semiconductors — Doping a semiconductor - Ideal diode - Unbiased diode - Forward bias - Reverse Bias — Breakdown - Barrier potential and temperature — Reverse biased diode — DC resistance of a diode - Load lines — Clipper — Clamper - Half-wave rectifier - Full-wave rectifier — Bridge Rectifier — Peak inverse voltage and surge current - Zener diode as a voltage regulator. Datasheet interpretation of diode. (7)

BIPOLAR JUNCTION TRANSISTOR : Unbiased and biased transistor - Transistor Currents – CE Connection - Base curve – Collector curve – Load line – Operating point - Transistor as switch – Emitter Bias - Voltage divider bias: Load line and Q-point - Two-supply emitter bias. Datasheet interpretation of transistor (6)

AMPLIFIERS : Two-transistor model – Analyzing an amplifier - Voltage gain – Loading effect of input impedance - Multistage amplifiers – CC amplifier - Output impedance - Cascading CE and CC - Darlington connections – Class A, Class B - Class C, Class D operation - Push-pull Emitter Follower (9)

OPERATIONAL AMPLIFIER : The 741 opamp – Inverting Amplifier – Non-inverting Amplifier - Characteristics and applications of opamp - Differential amplifier – Instrumentation amplifier - Summing Amplifier - Current Boosters - Low –pass filter. High pass filter - Bandstop filter – All-pass filter - Comparators with zero reference, non-zero reference, hysteresis - Window comparator - Integrator – Waveform conversion - Waveform generation – Datasheet interpretation of opamp (14)

OSCILLATORS AND VOLTAGE REGULATORS : Theory of sinusoidal oscillation — Wien-bridge oscillator - RC oscillator — Colpitts oscillator - LC oscillator — 555 Timer - Monostable and Astable operation of 555 timer - 555 timer applications - Phase-locked loop – Function generator ICs - Supply characteristics – Shunt regulator – Series Regulator — Current boosters - Fixed and adjustable three terminal regulators. (9)

Total L: 45

TEXT BOOKS:

1. Albert Malvino, David J. Bates , "Electronic Principle", Pearson Education, New Delhi, 2012.
2. Gayakwad A R, "OP-Amps and Linear Integrated circuits", Pearson Education, New Delhi, 2004.

REFERENCES:

1. Roy Choudhury, Shail Jain, "Linear Integrated Circuits", New Age International Limited, 2003.
2. Millman J, Halkias C C, Satyabrata J, "Electronic Devices and Circuits", Tata McGraw Hill, New Delhi, 2011.
3. Boylestead.L.R, Nashelsky.L, "Electronic Devices and Circuit Theory", Pearson Education India, New Delhi, 2002.
4. Anant agarwal, Jeffrey H.Lang , "Foundations of Analog and Digital Electronic Circuits", 1st Edition, Morgan Kaufmann, 2005.

19IR 303 ELECTRICAL MACHINES AND POWER SYSTEMS

3 0 0 3

DC MACHINES : Electromechanical energy conversion - Rotating machines - Driving and opposing torque - Faradays law - Generator mode and Motor mode - Constructional details of DC Machines - EMF equation - Methods of excitation — Self and separately excited Shunt generator - Principle of operation of DC Motor — back emf and torque equation - Characteristics of DC series and shunt motors - Starting of DC Motors, Need for Starters - Speed control and Braking of DC motors (Voltage Control & Dynamic Braking Only) - Principle of Brushless DC motors - Direct Drive High Torque Motors.

(11)

TRANSFORMERS: Constructional Details — Principle of Operation — EMF Equation — Transformation ratio - Transformer on no load — Parameters referred to HV/LV windings — Equivalent circuit - Dot Convention - Transformer on load- Regulation - Losses and efficiency - Load test - Three phase transformer connections - Introduction to Current and Potential Transformers - Applications of Transformer in Robotics and Automation.

(10)

INDUCTION MOTORS : Construction — Types — Principle of operation of three phase induction motors - Speed Torque characteristics - Equivalent circuit - Starting and Speed control - Single-phase induction motors (only qualitative analysis) - Introduction to Linear induction motor - PMSIM – Applications

(10)

SYNCHRONOUS AND SPECIAL MACHINES: Construction of Synchronous machines - Types — Induced emf - Working principles of: Brushless alternators-Stepper motor - Servomotor — Universal motor -. Applications – rating and duty cycle - Sizing of Motor for a Industrial application

(10)

INTRODUCTION TO POWER SYSTEM: Structure of electric power systems - Generation, transmission, sub- transmission and distribution systems - EHVAC and EHVDC transmission systems - Substation layout. (Concepts only). (4)

Total L: 45

TEXT BOOKS:

1. K Murugesh Kumar, "DC Machines and Transformers", Vikas Publishing House Pvt Ltd, 2010.
2. K Murugesh Kumar, "Induction and Synchronous machines", Vikas Publishing House Pvt Ltd, 2010.

REFERENCES:

1. V K Mehta, Rohit Mehta, "Principles of Power System", S.Chand and Company Ltd, 2003.
2. Haruhiko Asada, Kamal Youeef-Toumi, "Direct-Drive Robots Theory and Practice", The MIT Press, Cambridge, 1987.
3. AE Fitzgerald, Charles Kingsley, Stephen.D.Umans, "Electric Machinery", Tata McGraw Hill publishing Company Ltd, 2003.
4. J B Gupta, "Theory and Performance of Electrical Machines", S.K. Kataria and Sons, 2002.

19IR 304 THEORY OF MACHINES

3 0 0 3

BASICS OF MECHANISMS : Definitions: Link, Kinematic pair, Kinematic chain, Mechanism and Machine - Degree of freedom — Mobility — Kutzbach criterian - Grashoff's law - Kinematic inversions: Four bar and slider crank mechanism - Mechanical advantage - Transmission angle - Description of common mechanisms, applications of mechanisms.

(7)

KINEMATIC ANALYSIS: Displacement, velocity and acceleration analysis in simple mechanisms using graphical method.

(10)

SYNTHESIS AND FORCE ANALYSIS: Number and dimensional synthesis- two and three positions synthesis of four bar mechanisms. Free body diagrams, Inertia forces and moments. Balancing of rotating and reciprocating masses. (10)

CAMS : Introduction to Cams- Classifications, law of cam design, cam function / follower motion schemes: uniform velocity, parabolic, simple harmonic motion, cycloid motion paths and introduction to high speed cams. Layout of cam profiles for different types of followers - knife-edged and roller.

(9)

GEARS : Spur gear terminology and definitions. Fundamental law of toothed gearing and tooth forms. Helical, bevel, worm, and rack and pinion gears (basics only). Gear trains, epicyclic gear trains, differentials, automotive transmission gear trains and harmonic drives. (9)

Total L: 45

TEXT BOOKS:

1. Rattan S S, "Theory of Machines", Tata McGraw -Hill Publishers, New Delhi, 2009.
2. Norton L, "Kinematics and Dynamics of Machinery", 5th Edition, Tata McGraw -Hill Publishers, 2016.

REFERENCES:

1. Myszka, DH, "Machines and Mechanisms: Applied kinematic analysis", 4th Edition, 2012.
2. Shigley J E, Uicker J J, "Theory of Machines and Mechanisms", McGraw -Hill Inc., New Delhi, 2003.
3. Bevan.T, "Theory of Machines", CBS Publishers and Distributors, New Delhi, 2002.
4. Ghosh, Mallick.A K, "Theory of Machines and Mechanisms", Affiliated East West Private Limited, New Delhi, 1988.

19IR 305 DATA STRUCTURES AND ALGORITHMS

2 2 0 4

INTRODUCTION : Object oriented programming concepts - Structure of C++ program - Implementation of classes and objects in C++ - Data Structures - Types of Data Structures - Abstract Data Types - Algorithms : Properties - Complexity Analysis - Recurrence Relations - Asymptotic Notations (5+4)

ARRAYS AND LISTS: Representation of linear and multidimensional arrays - Operations — Applications - Representation of linked list - Operations on linked list: Traversal — Search — Insertion — Deletion - Doubly linked list - Circularly linked list - Applications: Addition of Polynomials; Sparse Matrix representation (7+7)

STACK AND QUEUE: Operations - Applications: Recursion handling, Evaluation of expressions - Queue Representation - Operations — implementation - Stack Representation - Circular Queues -Deque - Priority Queue - Applications (6+7)

TREES AND GRAPHS: Tree Terminologies -Binary Trees - Representation - Traversals - Threaded Binary Tree - Applications - Graph: Terminologies - Types of Graphs - Representation - Traversal - Breadth first search- Depth first search - Applications (6+6)

SORTING AND SEARCHING : Insertion sort, Selection sort, Bubble sort - Heap sort, Quick sort, Merge sort - Linear search, Binary search - Hashing: Hash functions - Collision resolution techniques - Searching using Hashing (6+6)

Total L: 30 +T: 30 = 60

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education, New Delhi, 2014.
2. Seymour Lipschutz, Vijayalakshmi Pai G.A, "Data Structures", Tata McGraw Hill, New Delhi, 2013.

REFERENCES:

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, New Delhi, 2014.
2. Yedidayah Langsam, Moshe J Augenstein, Aaron M Tannenbaum , "Data Structures using C and C++", PHI Learning, New Delhi, 2013.
3. Jean Paul Tremblay, Paul G Sorenson, "Introduction to Data Structures With Applications", Tata McGraw Hill, New Delhi, 2012.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed, "Ellis Horowitz, Fundamentals of Data structures in C", Universities Press, Hyderabad, 2014.

19IR 306 ECONOMICS FOR ENGINEERS

3 0 0 3

INTRODUCTION : Definition – Nature and Scope – Central Problems of an Economy – Positive and Normative Economics– Micro Economics and Macro Economics, Significance of Economics, Economic Assumptions (9)

THEORY OF CONSUMER BEHAVIOR: Utility — Indifference Curve Analysis - Properties, Consumer's Budget Line - Demand Analysis: Demand Function and Law of Demand, Elasticity of Demand. Demand forecasting using Econometric Techniques. Supply– Factors Affecting Supply, Market Equilibrium Price, Consumer Surplus (9)

PRODUCTION, COST AND REVENUE : Production Function, Total Product, Average Product and Marginal Product, Returns to Scale. Costs, Nature of Costs, Short-run and Long-run Cost Curves, Revenue concepts (9)

MARKET STRUCTURE : Types of Markets - Perfect Competition — Characteristics — Imperfect Competition: Monopoly – Monopolistic Competition – Oligopoly and Duopoly - Price Discrimination and Product Differentiation under Different Markets — Price and Output Determination in Short run and Long run and profit maximization. (9)

PERFORMANCE OF AN ECONOMY (MACRO ECONOMICS) : Demand and Supplyof Money– Quantity Theoryof Money, Banking — Functions of Commercial Banks and Central Bank — Inflation — Causes — Control Measures — National Income — Concepts — Methods of Calculating National Income — Problems in Calculating National Income. (9)

Total L: 45

TEXT BOOKS:

1. Varian H.R. , "Intermediate Microeconomics", East– West Press, New Delhi, 2014.
2. Dewett.K.K, Navalur. M.H. , "Modern Economic Theory", S. Chand, New Delhi, 2015.

REFERENCES:

1. William A, McEachern, Simrit Kaur, "Micro ECON", Cengage Learning, Noida, 2013.
2. William A, McEachern, Indira A, "Macro ECON", Cengage Learning, Noida, 2014.
3. Deepashree, "Principles of Economics", Ane Books Pvt Ltd, New Delhi, 2010.
4. Dwivedi, "Essentials of Business Economics", Vikas Publishing House Pvt Ltd, New Delhi, 2010.

19IR 310 ANALOG ELECTRONICS LABORATORY

0 0 2 1

1. Characteristics of Diode and its applications: Forward bias and Reverse bias; Rectifier; Clipper and Clamper
2. Characteristics of Zener diode and Zener voltage regulator
3. Characteristics of BJT – CE Configuration & Application of BJT as an amplifier and switch
4. Design and testing of RC phase shift oscillator.
5. Characteristics and linear Applications of Op-Amp: Inverting and Non-inverting amplifier; Slew rate and CMRR; Comparator and Level Detector; Summing and Difference Amplifier
6. Non-linear Applications of Op-Amp: Voltage and Current Sensing circuits; Integrator and Differentiator
7. Generation of waveform using Op-Amp and Pulse Width Modulator: Square, Triangle, Sine waveform
8. Performance characteristics of Voltage Regulator ICs: 7805, 7812, 723
9. Signal Conditioning of Sensor output from Thermpocouple using Op-Amp: TTL Driver, Lamp Driver, Buffer, LED Driver
10. Design and Implementation of Active Filter: Low pass and High pass Filter; Band pass and Band reject Filter

Total P: 30

REFERENCE:

1. Forrest M Mims, "A Handbook of Integrated Circuit Applications", Radio Shack, 1982.

19IR 311 MECHANICS AND MACHINES LABORATORY

0 0 2 1

MECHANICS :

1. Study of the effect of link length parameters on the output of a Four Bar Mechanism and Slider Crank Mechanism
2. Preparation of cam displacement curve and determination of jump speed of the cam.
3. Study on epicyclic gear train and worm wheel reducers.
4. Force analysis for Slider – Crank mechanism using Simulation Software.
5. Force analysis for four bar mechanism using Simulation Software. (15)

MACHINES :

1. Load characteristics of DC series and shunt motor.
2. Load test on three-phase induction motor.
3. Electrical braking of three-phase induction motor.
4. Load test on single phase transformers.
5. Study of typical power system and developing single line diagram. (15)

Total P: 30

REFERENCE:

1. Department of Robotics and Automation Engineering, "Mechanics and Machines Laboratory Manual", 2019.

19IR 312 ENVIRONMENTAL SCIENCE

2 0 0 0

INTRODUCTION TO ENVIRONMENT: Environment - Definition, scope and importance. Types and composition of atmosphere – particles, ions and radicals. Ozone layer-significance, formation and depletion. Ecosystems- Structure and functions, components, energy flow, food chains, food web, Biodiversity-levels, values and threats – India as a mega-diversity nation – hotspots of biodiversity – endangered and endemic species of India – conservation of biodiversity. (6)

ENERGY RESOURCES : Introduction – National and International status- exploitation - sustainable strategies- Fossil fuels-classification, composition, physico-chemical characteristics and energy content of coal, petroleum and natural gas; solar energy - introduction, harnessing strategies. Wind energy - availability, wind power plants, wind energy conversion systems, site characteristics, and types of wind turbines. Supporting renewable energy resources - tidal –geothermal - hydroelectric. (6)

ENVIRONMENTAL POLLUTION : Definition – Sources, causes, impacts and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards (h) RF hazards - Role of an individual in prevention of pollution. DISASTER MANAGEMENT: Floods, earthquake, cyclone and landslides – Case studies, consequences and rescue measures (6)

WASTE MANAGEMENT: Wastewater - Characteristics of domestic and industrial wastewater - COD and BOD – Various stages of treatment – primary, secondary, tertiary treatment- Biological and advanced oxidation processes. Solid waste management –

Characteristics of municipal solid waste(MSW), biomedical, automobile and e-wastes and their management – landfills, incineration, pyrolysis, gasification and composting. (6)

SOCIAL ISSUES AND THE ENVIRONMENT: Environmentally Sustainable work practices- Rain water harvesting – Role of non-governmental organizations. Human ethics and rights- impact on environment and human health – role of information technology on environment and human kind. Green IT policies, Process of EIA - ISO 14000. Legislation- Environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act–Wild life protection act–Forest conservation act. (6)

Total L: 30

TEXT BOOKS:

1. Gilbert M.Masters , "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi, 2004.
2. De A K , "Environmental Chemistry", New Age International P Ltd, New Delhi, 2006.

REFERENCES:

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
2. Koteswara Rao MVR, "Energy Resources: Conventional & Non-Conventional", BSP Publications, New Delhi, 2006.
3. Deswal S and Deswal A, "A Basic Course in Environmental Studies", Dhanpat Rai and Co, New Delhi, 2004.

SEMESTER - 4

19IR 401 PROBABILITY AND STATISTICS

2 1 0 3

PROBABILITY AND DISCRETE RANDOM VARIABLES : Probability, axiomatic approach to probability, Baye's theorem, probability distributions and probability mass functions, cumulative distribution functions, mean and variance, binomial, Poisson and geometric distributions. (6+3)

CONTINUOUS RANDOM VARIABLES : Probability distributions and probability density functions, cumulative distribution functions, mean and variance, exponential, normal and Weibull distributions. (6+3)

JOINT PROBABILITY DISTRIBUTIONS : Two dimensional discrete and continuous random variables, marginal probability functions, independence, covariance, correlation and linear regression. (6+3)

STATISTICAL INFERENCE : Point estimation - interval estimation — testing of hypothesis for means — large, small samples and matched pairs tests — testing of hypothesis for proportions, chi square test for goodness of fit and independence of attributes. (6+3)

VARIANCE TESTS AND ANALYSIS OF VARIANCE : Hypothesis concerning one variance, two variances, analysis of variance - completely randomized design, randomized block design. (6+3)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Douglas C. Montgomery and George C. Runger , "Applied Statistics and Probability for Engineers", Wiley India, New Delhi, 2018.
2. Richard A. Johnson, "Miller & Freund's, Probability and Statistics for Engineers", Prentice Hall, New Delhi, 2017.

REFERENCES:

1. Jay L. Devore , "Probability and Statistics for Engineering and the Sciences", Brooks/Cole, USA, 2015.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye , "Probability & Statistics for Engineers & Scientists", Pearson, New Delhi, 2016.
3. Robert V. Hogg, Elliot Tanis and Dale Zimmerman, "Probability and Statistical Inference", Pearson Education, USA, 2014.
4. J. Susan Milton and Jesse Arnold, "Introduction to Probability and Statistics", Tata McGraw Hill, New Delhi, 2017.

19IR 402 AUTOMATIC CONTROL SYSTEMS

3 1 0 4

INTRODUCTION : Components of Automatic control systems- Open loop and closed loop systems - Examples - Transfer function - Modeling of physical systems - Mechanical Systems - Translational and Rotational systems - Hydraulic systems and Electrical Systems - Transfer function of DC

servomotor - AC servomotor - Block diagram - reduction techniques - Signal flow graph - Mason's gain formula. (10+3)

TIME DOMAIN ANALYSIS : Continuous time signals - Standard Test signals - Classification of continuous time systems - Linear- Nonlinear - Time variant - Time invariant - Static - Dynamic - Time response of second order system - Time domain specifications - Types of systems - Steady state error constants -Generalized error series - Introduction to P, PI and PID modes of feedback control. - Introduction to lead, lag and lead-lag compensators (10+3)

FREQUENCY DOMAIN ANALYSIS : Frequency domain specifications - Estimation for second order systems- Correlation between time and frequency domain specifications for second order systems - . Bode plot — Determination of Transfer Function from Bode plot - All pass minimum phase and non-minimum phase systems - Polar plot - Determination of gain and phase Margins from the plots. (7+3)

STATE SPACE ANALYSIS : Limitations of conventional control theory - Concepts of state, state variables and state model - state model for linear time invariant systems - Introduction to state space representation using physical - Phase and canonical variables - State equations - Transfer function from the State model - Solutions of the state equations -State Transition Matrix - Concepts of controllability and observability. (9+3)

SYSTEM STABILITY : Concept of stability - stability & location of the poles in S-plane - Characteristic equation - Routh- Hurwitz stability criterion - Root Locus concepts- Construction of root locus — Root contours - Absolute and Relative stability - Nyquist stability - Nyquist stability criterion - Assessment of relative stability - Gain and Phase Margin. (9+3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

1. Smarajit Ghosh, "Control Systems Theory and Applications", 2nd Edition, Pearson Education, New Delhi, 2012.
2. Ogata K, "Modern Control Engineering", 5th Edition, Pearson Education, New Delhi, 2009.

REFERENCES:

1. Nagrath I J, Gopal M, "Control Systems Engineering", 5th Edition, Prentice Hall of India, New Delhi, 2008.
2. Richard C Dorf , Robert H Bishop , "Modern Control Systems", 12th Edition, Addison-Wesley, New Delhi, 2010.
3. Norman S Nise, "Control System Engineering", 6th Edition, John Wiley & Sons, Singapore, 2012.
4. S Palani, "Control Systems Engineering", 2nd Edition, McGraw Hill Education Pvt. Ltd, New Delhi, 2010.

19IR 403 BASICS OF ROBOTICS

3 0 0 3

INTRODUCTION : Classification of Robots based on Geometry, Workspace, Actuation, Control and Application - Advantages and Disadvantages of Robots - Robot Components: Link, Joint, Manipulator, Wrist, End-effector : Gripper – Types, Actuator and Sensor - Configuration space – Joint Space – Workspace, Robot Specifications: Number of Axes: Internal and External (7-axis robot) - Capacity and Speed, Reach and Stroke, Tool Orientation, Repeatability, Precision and Accuracy, Operating Environment. (5)

HOMOGENEOUS TRANSFORMATIONS : Degrees of Freedom – Matrix Representation: Representation of a point and vector in space, Global and Local Coordinate axes - Homogeneous Transformation Matrices – Transformations: Representation of pure translation, Representation of pure Rotation - Representation of Combined Transformations - Inverse of Transformation Matrices - Euler Angles – Roll, Pitch, Yaw angles - Quaternions–Spinors and Rotators

(6)

FORWARD KINEMATICS : Denavit-Hartenberg Notation - Transformation between two Adjacent Coordinate Frames Forward Kinematics of Two, Three, Four, Five and Six axis Robots. (12)

INVERSE KINEMATICS : Decoupling Technique - Inverse Transformation Technique - Inverse position: Geometric Approach – Inverse Orientation - Inverse Kinematics of Two, Three, Four, Five and Six axis Robots. (10)

VELOCITY KINEMATICS : Angular Velocity – Linear Velocity - Jacobian representation of Linear and Angular Velocity Calculation of Jacobian for Two, Three and Four axis Robots - Inverse Jacobian - Singularities: Wrist and Arm Singularities - Manipulability - Induced joint torques and forces. (12)

Total L: 45

TEXT BOOKS:

1. Mark W. Spong, Seth Hutchinson, M. Vidyasagar, "Robot Modeling and Control", Wiley, 2012.
2. Niku S B, "Introduction to Robotics, Analysis, Control, Applications", John-Wiley & Sons Inc, 2011.

REFERENCES:

1. Robert J. Schilling, "Fundamentals of Robotics, Analysis and Control", PHI Learning, 2009.
2. Reza N Jazar, "Theory of Applied Robotics", Springer, 2010.
3. Saha S K, "Introduction to Robotics", Tata McGraw Hill Education Pvt. Ltd, 2010.
4. Tadej Bajd, Matjaž Mihelj, Marko Munih, "Introduction to Robotics", Springer, 2013.

19IR 404 DIGITAL ELECTRONICS

3 0 0 3

NUMBER SYSTEMS AND BOOLEAN ALGEBRA : Review of Number Systems - Number representation: Signed , Unsigned, Fixed point, Floating point - Computer codes-BCD, Gray code, Excess 3 code, Error detection and correction codes, Parity, Hamming codes - Boolean algebra-Basic Postulates and theorems - Switching functions Canonical forms - Logic gates (6)

DIGITAL LOGIC FAMILIES : Characteristics of digital ICs – Voltage and current ratings, Noise margin, Propagation delay, Power dissipation - TTL logic family-Inverter - Totem pole, Open collector and tri-state outputs – NMOS Inverter, CMOS Inverter - ECL logic families - comparison of performance of various logic families (9)

COMBINATIONAL LOGIC DESIGN : Standard representation of logic functions - Incompletely specified functions - Simplification of logic functions through K-maps and Quine–McClusky method - Implementation using logic gates. Decoders, Encoders, Multiplexers and Dem utiplexers - Implementation of Combinational circuits using Multiplexers and Demultiplexers - Arithmetic circuits: Binary /BCD adders and subtractors - Magnitude comparator (11)

SEQUENTIAL CIRCUITS: General model of sequential circuits - Latches, Flip Flops - Latches, Flip Flops - Master slave configuration - Binary counters - Shift register, Ring counter, Johnson counter-Timing diagram - Mealy/Moore models - Concept of state, State diagram, state assignment, State table - Design of synchronous sequential circuits – Up- down/Modulu scounters-Sequence detector. (11)

MEMORY AND PROGRAMMABLE LOGIC DEVICES : Classification of memories - Types of ROM-PROM, EPROM, EEPROM, RAM-static RAM, Dynamic RAM - Introduction to PLDs-ROM-PAL-PLA - architecture of PLDs - implementation of digital functions using PLDs (8)

Total L: 45

TEXT BOOKS:

1. Alan B Marcovitz , "Introduction to Logic Design", Second, Tata McGraw Hill, New Delhi, 2005.

2. Tocci R J, Widmer N and Moss G, "Digital Systems: Principles and Applications", Pearson, New Delhi, 2013.

REFERENCES:

1. Donald Givone, "Digital Principles and Design", Tata McGraw Hill, New Delhi, 2012.
2. Floyd T L , "Digital Fundamentals", Pearson Education, New Delhi, 2009.
3. Tokheim R L, "Digital Electronics - Principles and Applications", Tata McGraw Hill, New Delhi, 2007.
4. John F Wakerly, "Digital Design Principles and Practices", Prentice Hall of India, New Delhi, 2005.

19IR 405 HYDRAULICS AND PNEUMATICS

3 0 0 3

INTRODUCTION TO FLUID POWER : Introduction to fluid mechanics: Pascal‟s Law, Bernoulli‟s equation, Properties hydraulic fluids, air, Selection of hydraulic fluids, comparison between hydraulics and pneumatics, Symbols of hydraulic and pneumatic elements. (9)

ELEMENTS OF HYDRAULIC SYSTEMS : Pumps - types, characteristics, Valves for control of direction, flow and pressure - types, typical construction details. Actuators – types and constructional details, Accumulators – types and application circuits, Intensifiers, Servo and Proportional valves – types and operation. (9)

HYDRAULIC SYSTEM DESIGN : Industrial Circuits: Deceleration circuit, regenerative circuits, feed circuits, sequencing circuits, synchronizing circuits, fail-safe circuits, Power pack–elements, design, Pipes- material, pipe fittings, Maintenance of hydraulic systems, Selection criteria for cylinders, valves, hydraulic system design for robotic application. (9)

ELEMENTS OF PNEUMATIC SYSTEM : Compressors-types, constructional details of filter, regulator, lubricator, constructional features- types of actuators, control valves for direction, pressure and flow, air motors, air hydraulic equipments. (9)

PNEUMATIC CONTROL SYSTEM DESIGN : General approach to circuit design, schematic layout, travel step diagram, control modes, program control, sequence control, cascade method, Karnaugh-Veitch mapping, Electro pneumatics, ladder diagram and PLC programming for specific hydraulic and pneumatic applications, Pneumatic system design for robotic application (9)

Total L: 45

TEXT BOOKS:

1. Anthony Esposito , "Fluid Power with Application", Pearson Education Pvt. Ltd, 2003.
2. Srinivasan R , "Hydraulic and Pneumatic Controls", McGraw –Hill education Pvt. Ltd, 2011.

REFERENCES:

1. Majumdar S R, "Oil Hydraulic Systems: Principles and Maintenance", Tata McGraw- Hill, New Delhi, 2003.
2. Majumdar S R, "Pneumatic Systems: Principles and Maintenance", Tata McGraw- Hill, 1996.
3. Werner Deppert , Kurt Stoll , "Pneumatic Controls: An Introduction to Principles", Vogel-Druck Wurzburg, 1975.
4. Peter Rohner, "Fluid Power Logic Circuit Design – Analysis, Design, Method and Worked Examples", Macmillan Press Ltd., 1979.

19IR 406 PLC AND SCADA

3 0 0 3

INTRODUCTION : History and developments in Industrial Automation - Vertical Integration of Industrial Automation - Control elements in Industrial Automation – Safety standards - PLC Introduction : Basics of PLC – Advantages - Capabilities of PLC - Architecture of PLC - Scan cycle - Types of PLC : Types of I/O modules - Configuring a PLC - PLC wiring (9)

PROGRAMMING OF PLC : Introduction to state machine theory - Types of Programming - Process Control Programs using Relay Ladder Logic - PLC arithmetic functions - Timers and counters –data transfer- Comparison and manipulation instructions - PID instructions - PTO /PWM generation (9)

NETWORKING OF PLCS : Industrial Networking Buses (Flow Diagram Only) – Comparison of Industrial Buses - Protocols-Fieldbus -Process busand ControlNet–DeviceNet-Ethernet-EtherCAT–CANbus protocol (9)

SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) : SCADA overview – Developer and runtime packages Architecture - Tools - Tag - Internal & External graphics - Alarm logging - Tag logging - Trends – History - Report generation - Communication Protocols of SCADA - Proprietary and Open Protocols. OLE/OPC - DDE - Server/Client - Interfacing of SCADA with PLC and other field devices (10)

HMI SYSTEMS : Necessity and Role of HMI in Industrial Automation – Types of HMI panels :Text display – operator panels - Touch panels - Panel PCs - Integrated displays, interfacing PLC to HMI (4)

APPLICATIONS OF PLC & SCADA: Case studies of Machine automation, Process automation (4)

Total L: 45

TEXT BOOKS:

1. John W Webb and Ronald A Reis , "Programmable logic controllers: Principles and Applications", Prentice Hall India, 2011.
2. Hans Berger , "Automating with Simatic S7-1200", Publicis Publishing, 2018.

REFERENCES:

1. W. Bolton , "Mechatronics", Pearson Education, 2011.
2. Kelvin T Erikson , "Programmable Logic Controllers", Dogwood Valley Press, 2016.
3. Rajesh Mehra , "PLCs & SCADA : Theory and Practice", Laxmi Publications, 2016.
4. R.S.Manoj , "Industrial Automation with SCADA : Concepts, Communications and Security", Notion Press, 2019.

19IR 410 DIGITAL AND CONTROL SYSTEMS LABORATORY

0 0 2 1

DIGITAL :

1. Study of basic digital ICs and implementation of arithmetic circuits (Adder and Subtractor)
2. Design and implementation of code converters.
3. Design and testing of Multiplexers/Demultiplexers using gates
4. Design and implementation of counters and shift registers
5. Real time Implementation of A/D conversion (15)

CONTROL SYSTEMS :

1. Determination of transfer function and speed control of AC servomotor
2. PID tuning in temperature control applications
3. Single axis control and disturbance rejection of BLDC and Inverted pendulum using PID
4. Time domain Response of Quad Copter
5. Frequency response of 1D single axis Robot manipulator, 2D point mass, 3DoF differential drive (15)

Total P: 30

REFERENCE:

1. Department of Robotics and Automation Engineering, "Digital and Control Systems Laboratory Manual", 2019.

19R411 HYDRAULICS AND PNEUMATICS LABORATORY

0 0 2 1

1. Design of simple pneumatic and hydraulic circuits using basic components
2. Construction and testing of multiple pneumatic actuator circuit using Cascade/ KV map method
3. Testing of multiple pneumatic actuator circuit with time delay valve and pneumatic counter
4. Co-ordinated motion of actuators using electro – pneumatic elements
5. Construction and testing of a hydraulic actuator application circuit
6. Co-ordinated motion of actuators using electro – hydraulic elements
7. Design and Simulation of hydraulic circuits using simulation software
8. Design and Simulation of pneumatic circuits using simulation software
9. Design and Testing of two hand safety circuit in a hydraulic punching machine
10. Design and testing of pneumatic grippers

REFERENCE:

1. Department of Robotics and Automation Engineering, “Hydraulics and Pneumatics Laboratory Manual", 2019.

19IR 412 PLC AND SCADA LABORATORY

0 0 4 2

1. PLC wiring for three phase induction motor starting and direction control
2. Developing Ladder logic diagram for Boolean functions and verification using I/O devices
3. Implementation of Timer, Counter, Compare and Math instructions using PLC
4. Implementation of analog and PWM control using PLC and HMI
5. Tuning of PID based temperature control
6. Speed control of AC servo motor using PLC
7. Design of conveyor automation system using SCADA
8. Design of SCADA based water management system
9. Picture window control in SCADA
10. Control and monitoring of VFD

Total P: 60

REFERENCE:

1. Department of Robotics and Automation Engineering, " PLC and SCADA Laboratory Manual", 2019.

SEMESTER - 5

19IR 501 CNC MACHINES

3 0 0 3

INTRODUCTION : History - Advantages and disadvantages of CNC, block diagram of CNC - Features available in CNC systems - Types- Turning centres, machining centres, grinding machines, EDMs, turret punch press, laser and water jet cutting machines - Constructional details of Turning centres, and machining centres - Machine accessories, Axis representations, Operator panel - Various modes of operation - Feed selection and MPG (8)

CNC PART PROGRAMMING PROCESS : Basic G and M codes, Structure of part program - Absolute and Incremental systems - Tooling concepts, Tool offsets, part geometry and writing of tool motion statements - Development of simple manual part programs for turning operations - Simple part programming for milling - CNC turning and milling part programming using canned cycles - Post processors - CNC part programming with CAD/CAM systems (9)

CNC SYSTEMS : Functions of CNC, system hardware, CPU, PLC, Servo control, Interfacing with keyboard, monitor, field inputs, outputs - Contouring control - interpolation, Parameters and diagnosis, compensation for machine accuracies - Open architecture systems and PC based controllers - Networking of CNC machines – Ethernet, IoT- Interfacing of robot with CNC (7)

DRIVE UNITS : Axis drive arrangements, guide ways, ball screw and nut, bearing arrangements, timing belts and couplings - sizing of servomotors for axis drives - DC and AC servo drives and servomotors, servo tuning - Selection criteria - drive optimization and protection - Spindle motors and drives- DC and AC (7)

CONTROL AND FEEDBACK DEVICES : Electrical cabinet and control panel wiring, Electrical standards - Control panel layout and arrangement of control elements, cables and terminations - Applications of feedback devices in CNC machines- Absolute and incremental encoders, resolvers, linear scales, Proximity switches, limit switches – Thermal sensors, pressure and float switches - Hydraulic systems of a CNC lathe (7)

ECONOMICS AND MAINTENANCE : Factors influencing the selection of CNC Machines - Machine accessories- Conveyors, Turret, ATC, APC - Cost of operation of CNC Machines, Testing of CNC Machines - Safety considerations- software and hardware interlocks - Maintenance of CNC Machines, Preventive Maintenance, TPM - Selection and sizing of Isolation Transformer for CNC Machine - Earthing standards for CNC machines (7)

Total L: 45

TEXT BOOKS:

1. HMT Limited, "Mechatronics", Tata McGraw Hill, New Delhi, 1998.
2. Radhakrishnan P, "Computer Numerical Control Machines", New Central Book Agency, 1992.

REFERENCES:

1. Yorem Koren, "Computer Control of Manufacturing Systems", Pitman, London, 1987.
2. Steve F Krar, "Computer Numerical Control Simplified", Industrial Press, 2001.
3. Peter Smid, "CNC Programming Techniques", 1st Edition, Industrial Press, Inc., 2005.
4. B. S. Pabla, M Adithan, "CNC Machines", 3rd Edition, New Age International, New Delhi, 2014.

19IR 502 DYNAMICS AND CONTROL OF MANIPULATORS

2 1 0 3

ACCELERATION AND MOTION DYNAMICS : Angular Acceleration Vector and Matrix - Rigid Body Acceleration – Forward Acceleration Kinematics – Inverse Acceleration Kinematics - Force and Moment – Rigid Body Translational and Rotational Kinetics - Mass Moment of Inertia Matrix - Lagrange"s form of Newton Equations - Lagrangian Mechanics (6+2)

ROBOT DYNAMICS: Rigid-link Newton Euler Dynamics - Robot Lagrange Dynamics - Lagrange Equations and Link Transformation Matrices. (7+3)

PATH PLANNING: Cubic Path – Polynomial path - Manipulator motion by Joint path - Cartesian path – Rotational Path - Manipulator motion by end-effector path (6+4)

TIME OPTIMAL CONTROL: Minimum time and bang-bang control - Floating Time Method - Time-optimal Control for Robots (4+2)

CONTROL TECHNIQUES: Open and Closed loop control - Computed Torque Control - Linear Control Technique - Sensing and Control (7+4)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Reza N Jazar , "Theory of Applied Robotics", Springer, 2010.
2. Niku S B, "Introduction to Robotics, Analysis, Control, Applications", John-Wiley & Sons Inc, 2011.

REFERENCES:

1. Mark W. Spong, Seth Hutchinson, M. Vidyasagar, "Robot Modeling and Control", Wiley, 2012.
2. Robert J. Schilling, "Fundamentals of Robotics Analysis and Control", PHI Learning, 2009.
3. Saha S K, "Introduction to Robotics", Tata McGraw Hill Education Pvt. Ltd, 2010.
4. Mark W. Spong, M.Vidyasagar , "Robot Dynamics and Control", Wiley, 2008.

19IR 503 MICROPROCESSORS AND MICROCONTROLLERS

3 0 0 3

ARCHITECTURE AND PROGRAMMING OF 8 BIT MICROPROCESSOR : Functional Block Diagram – Registers - ALU, Bus systems - Addressing modes - Instruction set - Development of Assembly language programs – Machine cycles and Timing diagrams (12)

8051 MICROCONTROLLER : Architecture of 8051 - Memory organization - Register Banks - Bit addressable area - SFR area – Addressing modes - Instruction set - Programming examples 8051 Interrupt structure – Timer modules - Serial features - Port structure - Powersaving modes (13)

TYPICAL APPLICATIONS : Multiplexed seven segment LED Display systems - Stepper Motor Control - Servo motor control - AC Power Control - Interfacing A/D Converter and D/A Converter - Square Waveform generation (6)

ARM PROCESSORS : ARM Programmer"s Model –Registers - Processor Modes –State of the processor - Condition Flags–ARM Pipelines - Exception Vector Table – ARM Processor Families - Typical 3 stage pipelined ARM organization - Introduction to ARM Memory Management Unit (9)

PROGRAMMING OF ARM PROCESSORS : ARM Addressing Modes - ARM Instruction Set Overview - T h u m b Instruction Set Overview. (5)

Total L: 45

TEXT BOOKS:

1. Ramesh S Goankar , "Microprocessor Architecture: Programming and Applications with the 8085", Penram International, 2000.
2. Muhammed Ali Mazidi , "The 8051 Microcontroller and Embedded Systems", Pearson Education India, 2000.

REFERENCES:

1. INTEL , "8-bit Embedded Controllers", User"s Manual, Intel Corporation, 1990.
2. William Hohl , "ARM Assembly Language Fundamental and Techniques", CRC Press Taylor & Francis, 2009.
3. Andrew Sloss , "ARM System Developer"s Guide", Morgan Kaufmann Publishers, 2005.

19IR 504 DESIGN OF MECHANICAL TRANSMISSION SYSTEMS

2 1 0 3

DESIGN OF SHAFTS, KEYS AND COUPLINGS : Shafts -Types and application - Forces on shafts due to gears and belts, estimation of shaft size based on strength–Keys, types and applications, Design of keys - Couplings, types and applications, design of rigid couplings. (7+4)

ROLLING CONTACT BEARINGS : Bearings – Types and application, Rolling contact bearings - Static and dynamic load capacity, Equivalent bearing load, probability of survival, Bearing life -Selection of deep groove ball bearings. (5+2)

DESIGN OF GEARS : Gears – Types- Applications – Gear materials – Gear tooth failures - Nomenclature, interference, gear forces , backlash and lubrication, Design of spur gear and helical gears (7+4)

DESIGN OF GEAR BOXES : Geometric progression- standard step ratio- Ray diagram, Kinematics layout- Design of sliding mesh gear box and constant mesh gear box, Introduction to harmonic drives. (5+2)

BELTS AND CHAINS : Belts -Types and application - Selection of flat and timing belts for given power and velocity ratio - Chains -Types and application - Selection of roller chain for specific applications (6+3)

Total L: 30 +T: 15 = 45

TEXT BOOKS:

1. Robert L Norton, "Machine Design - An Integrated Approach, Pearson Education", New Delhi, 2013.
2. Bandari V B, "Design of Machine Elements", 4th Edition, McGraw Hill Education India, 2016.

REFERENCES:

1. Shigley and Mische , "Mechanical Engineering Design", McGraw Hill Education India, 2003.
2. Faculty of Mechanical Engineering, PSG College of Technology, "PSG Design Data Book", Kalaikathir Achchagam, 2015.
3. Robert L Mortt , "Machine Elements in Mechanical Design", Pearson Prentice Hall, 2014.
4. Prabhu.T.J, "Design of Transmission Elements", Mani Offset, Chennai, 2003.

19IR 510 CNC AND CAD LABORATORY

0 0 4 2

1. Basic part programming and machining for turning centre using FANUC controller
2. Part programming and machining using turning and drilling cycle for turning centre using FANUC controller
3. Part programming and machining using grooving and threading cycle for turning centre using FANUC controller
4. Basic part programming and machining for machining centre using FANUC controller
5. Programming and simulation for turning center using simulation software
6. Programming and simulation for machining center using simulation software
7. Troubleshooting of CNC machines
8. Modeling of engineering components using modeling software
9. Assembly of engineering components using modeling software
10. Extraction of production drawing from solid model using modeling software

Total P: 60

REFERENCE:

1. Department of Robotics & Automation Engineering, "CNC and CAD Laboratory Manual", 1st Edition, PSG CT, Coimbatore, 2019.

19IR 511 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

0 0 2 1

1. Addition and Subtraction using 8051 microcontroller
2. Multiplication and Division using 8051 microcontroller
3. Seven-segment display interfacing with 8051 microcontroller
4. Interfacing 8051 with keypad
5. LCD interfacing with 8051 microcontroller
6. Interfacing DAC and ADC with 8051
7. Generating PWM with ARM7 processor and interfacing with power MOSFET
8. Traffic light control using ARM7 processor
9. Sensor interfacing with ARM7
10. Relay and Switch interfacing with ARM7 processor

Total P: 30

REFERENCE:

1. Department of Robotics and Automation Engineering, "Microprocessor and Microcontroller Laboratory Manual", 2019.

19IR 512 ROBOTICS LABORATORY

0 0 2 1

1. Forward kinematics of two axis planar articulated robot using analytical and DH algorithm
2. Inverse kinematics of two axis planar articulated robot using geometric approach and DH algorithm
3. Jacobian and induced force-torque analysis of two axis planar articulated robot
4. Implementation of trajectory planning algorithm for straight line motion of two axis planar articulated robot
5. Implementation of trajectory planning algorithm for curved path of two axis planar articulated robot
6. Newton Euler and Lagrangian method to relate force and torque for different configurations
7. Programming of Four-axis Systemantics and Five-axis TAL Brabo industrial robots
8. Programming of Six-axis Universal industrial robots
9. Analysis and Simulation using Fanuc Robo guide software and real time Programming of Fanuc M 710i robot
10. Programming of Kinova Robotic Arm

Total P: 30

REFERENCE:

1. Department of Robotics and Automation Engineering , "Robotics Laboratory Manual", 2019.

SEMESTER - 6

19IR 601 POWER ELECTRONICS AND DRIVES

3 0 0 3

POWER SEMICONDUCTOR DEVICES : Power diodes - Power transistors - Characteristics of SCR - TRIAC – Power MOSFET - IGBT - Thyristor protection circuits - Thyristor triggering circuits- Selection of device (9)

CONVERTERS : Single phase - Three phase - Fully controlled rectifiers - Effect of source and load inductance -single phase- Three phase AC voltage controller -Control Circuits for AC to DC and AC toAC converters. (8)

INVERTERS AND CHOPPERS : Voltage Source inverters - bridge inverters- 120° and 180° conduction - Pulse Width Modulation - Single and Multiple PWM - SPWM - Generation of pulses for SPWM - DC choppers : Buck- Boost - Buck Boost Generation of timing pulses for DC choppers - Applications (Block diagram approach) Uninterrupted power supplies - SMPS - Basics of Magnetic design for power electronics (13)

INTRODUCTION TO DRIVES : Basic Elements of Drive - Load characteristics - Selection of Drive (2)

DRIVES FOR AUTOMATION : Operating modes - quadrant operation of chopper - Closed loop control of DC drives. Stator and rotor voltage control - frequency and voltage control - Current Control - Basics of vector control- Block diagram - Stepper Motor Drive - BLDC Motor Drive - PMSM Drive-protection devices for drives (11)

POWER QUALITY : Overview of Harmonics - Introduction to Power quality (2)

Total L: 45

TEXT BOOKS:

1. Rashid M H , "Power Electronics –Circuits, Devices and Applications", PHI, 2014.
2. Ramu Krishnan , "Electric Motor Drives: Modeling, Analysis, and Control", Prentice Hall, 2001.

REFERENCES:

1. Bimal K Bose, “Modern Power Electronics and AC Drives", Pearson Education, 2002.
2. Roger C Dugan, Surya Santoso, Mark F McGranaghan , "Electrical Power Systems Quality", McGraw Hill, 2003.
3. Mohan, Undel, "Power Electronics", John Wiley and sons, 2003.
4. Vedam Subramaniam , "Thyristor control of Electrical Drives", Tata McGraw-Hill, 1998.

19IR 602 AUTOMATION SYSTEM DESIGN

2 1 0 3

INTRODUCTION TO PROCESS AUTOMATION : Process Automation – paper industry, packaging industry, food processing industry, Integrated design issues in automation systems, the Mechatronics design process- benefits, modeling of electromechanical systems, bond graph technique, Automation migration strategy - building blocks of automation systems. (6+2)

SELECTION OF MOTION COMPONENTS : Selection of motor for automation system, Calculation of inertia force for motor, LM Guide ways, Ball screws, Selection, from the manufacturer"s catalogue based on the applications. (8+3)

TRANSFER LINES AND AUTOMATED ASSEMBLY : General terminology-takt time, setup time and cycle time, Automated flow lines with storage buffers. Automated assembly-design for automated assembly, types of automated assembly systems, part feeding devices, analysis of multi-station assembly machines - modular fixturing - Flow line balancing. (6+3)

DESIGN FOR HIGH-SPEED AUTOMATIC ASSEMBLY: Introduction, Design of parts for high speed feeding and orienting, high speed automatic insertion, Analysis of an assembly, General rules for product design for automation – Application of high speed automatic assembly. (5 + 5)

SYSTEM INTEGRATION : Issues and systematic approaches, design and simulation using CIROS software, economics of automation systems design and implementation (5 + 2)

Total L: 30 +T: 15 = 45

TEXT BOOKS:
1. Mikell P Groove, "Automation Production Systems and Computer Integrated Manufacturing", Pearson education, New Delhi, 2016.
2. Geoffery Boothroyd, "Assembly Automation and Product Design", CRC Press, USA, 2016.

REFERENCES:
1. DevadasShetty , "Mechatronics System Design", PWS Publishing Company, USA, 2010.
2. Wilfried Voss, "A Comprehensible Guide to Servo Motor Sizing", Copperhill Technologies Corporation, Massachusetts, 2007.

19IR 603 AI FOR ROBOTICS

3 1 0 4

INTRODUCTION TO AI AND INTELLIGENT AGENTS : Foundations, History - Intelligent agents, Agents - Nature of Environments, Structure of agents - Problem solving agents - Problem formulation - State space, Search space - Problem reduction - Searching for solutions: Uninformed search strategies – Informed search strategies - Heuristic functions (9+3)

ROBOTIC PARADIGMS : Overview of the Three Paradigms - Hierarchical Paradigm: attributes – representative architectures - Reactive paradigm: attributes - subsumption architecture - potential field methodologies - Designing a reactive implementation: a primitive move-to-goal behavior, an abstract follow-corridor behavior - Designing a Reactive Behavioral System - The Hybrid Deliberative/Reactive Paradigm- Attributes - Architectural Aspects- Managerial Architectures- State-Hierarchy Architectures Model-Oriented Architectures (12+3)

TOPOLOGICAL AND METRIC PATH PLANNING: Landmarks and gateways - relational methods – associative methods - case study - Metric Planning: Configuration Space-Cspace representations - graph based planners - wavefront based planners - Interleaving Path Planning and Reactive Execution (9+3)

LOCALIZATION AND MAP MAKING: Sonar sensor model - Bayesian– Dampster-Shafer theory - HIMM - comparison of methods - localization – exploration (8+3)

LEARNING AND NATURAL LANGUAGE PROCESSING: Forms of learning - NLP: Language models - Natural language for communications - Speech recognition (7+3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:
1. Robin R. Murphy, "Introduction to AI Robotics", MIT Press, 2000.
2. Start Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education, New Delhi, 2015.

REFERENCES:
1. Francis X. Govers, "Artificial Intelligence for Robotics", Packt, 2018.
2. Roland Siegwart, Illah R. Nourbakhsh , "Introduction to Autonomous Mobile Robots", MIT Press, 2004.
3. Kevin Knight, Elaine Rich, Nair , "Artificial Intelligence", Tata McGraw Hill, New Delhi, 2017.
4.Jon Gabriel, "Artificial Intelligence: Artificial Intelligence for Humans", 1st Edition, Createspace Independent Publishers, 2016.

19IR 604 VISION SYSTEMS

3 0 0 3

INTRODUCTION TO COMPUTER VISION: Cameras: Pinhole cameras-Cameras with lenses-Sensing - Geometric Camera Models: Elements of Analytical Euclidean geometry - Camera parameters & perspective projection-Affine Cameras& Affine Projection - Radiometry: Light in space-Light at surfaces-Image formation: Geometry primitives and transformation (7)

SINGLE IMAGE VISION : Image Processing: Point operators-Linear Filtering- Neighborhood operators - Fourier transform – Pyramids and Wavelets-global optimization - -Feature detection & matching: Points & Patches-Edges- Lines-Segmentation - Active contours-Split & merge-Mean shift & Mode finding (10)

MULTIPLE IMAGE VISION : Geometry of multiple views-Camera Calibration for stereo Cameras - Structure from motion: Triangulation-Two frame structure from motion - Factorization- Bundle adjustment-Constrained structure from motion - Dense motion estimation: Transactional alignment-parametric motion-spline band motion-optical flow-Layered motion - Image stitching: Motion models-global alignment-compositing (10)

HIGH LEVEL VISION: Stereo correspondence: Epipolar geometry-sparse correspondence-Dense correspondence-Multi view stero - 3D reconstruction: shape from X- Active range fringing- surface representation - Recognition-Object detection- Face recognition-Instance recognition - Introduction to deep learning in computer vision (11)

ROS FOR COMPUTER VISION : Basic introduction to Robotic operating System (ROS) - installing and testing ROS camera Drivers - ROS to OpenCV - The CV_bridge Package - Introduction to OpenCV image processing library and MATLAB programming (7)

Total L: 45

TEXT BOOKS:

1. David.A. Forsyth, Jean Ponce , "Computer Vision a Modern Approach", Pearson, Upper Saddle River, 2010.
2. Richard Szeliski , "Computer Vision: Algorithms and Applications", Springer, London, 2014.

REFERENCES:

1. Damian M Lyons , "Cluster Computing for Robotics and Computer Vision", World Scientific, Singapore, 2011.
2. Richard Hartley, Andrew fisherman , "Multiple view geometry in computer vision", 2012.
3. Carsten Steger, Markus Ulrich, Christian Weidman , "Machine Vision Algorithms and Applications", WILEY-VCH, Weinheim, 2008.
4. Kenneth Dawson-Howe , "A Practical Introduction to Computer Vision with OpenCV", Wiley, Singapore, 2014.

19IR 605 SENSORS AND INSTRUMENTATION

3 0 0 3

FUNCTIONAL DESCRIPTIONS OF MEASURING INSTRUMENTS : Functional elements of an instrument - Measurement Errors: Gross errors and systematic errors, Absolute and relative errors - I/O configuration of measuring instruments - Static characteristics: Meaning of static calibration, accuracy, precision and bias, Static sensitivity, linearity, threshold, resolution, hysteresis and dead space, Scale readability, Span, generalized static stiffness and input impedance - Basics of Dynamic characteristics - Inertia Measurement Unit. (8)

TEMPERATURE MEASUREMENT : Principle of operation- Bimetallic thermometer, Resistance Temperature Detectors, Thermistors, Thermocouples, IR thermometers, Integrated circuit temperature transducer (7)

PRESSURE AND FLOW MEASUREMENT : Principle of operation - Liquid manometers, Resistive transducer, Capacitance transducer, Piezoelectric transducer, Venturi flow meters, Electro-Magnetic flow meter - liquid level measurement using float (7)

DISPLACEMENT AND VELOCITY MEASUREMENT : Linear and angular measurement systems – Resistance potentiometer, strain gauge - capacitive transducers and variable inductance transducers, resolvers, LVDT, proximity sensors, ultrasonic and photo-electric sensors - linear scales - Laser Interferometers, tachogenerator - Encoders: absolute and incremental – Piezoelectric (8)

OTHER SENSORS : Sensors for measurement of vibration, Acoustics, humidity, weight, volume and radiation - Tactile sensors: force, torque, pressure, Gyroscope - Vision based sensors- Smart sensors (7)

SIGNAL CONDITIONING AND INTERFACING : Signal conditioning, Passive interfacing- matching power, signal and impedance - operational amplifier circuits, Modulation, filters - A/D converters, Interfacing to computer - effects of EMI and EMC- DAQ systems (8)

Total L: 45

TEXT BOOKS:

1. Peter Elgar , "Sensors for Measurement and Control", Addison-Wesley Longman Ltd, 1998.
2. A K Sawhney , "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai and Co, 2010.

REFERENCES:

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin , "Robotics Engineering: An Integrated Approach", PHI Learning, New Delhi, 2009.
2. Patranabis D , "Sensors and Transducers", Prentice-Hall of India Private Limited, New Delhi, 2003.
3. Ernest O Doebelin , "Measurement systems Application and Design", Tata McGraw-Hill Book Company, 2010.
4. Robert B. Northrop , "Introduction to Instrumentation and Measurements", 3rd Edition, CRC Press, 2014.

19IR 610 POWER ELECTRONICS AND DRIVES LABORATORY

0 0 4 2

1. Single Phase and Three Phase Diode Bridge Rectifier with R and RL Load
2. Single phase fully controlled thyristor converter with R and RL load
3. Three phase fully controlled thyristor converter
4. DC chopper with R and RL load
5. Single phase AC voltage controller with R and RL load
6. Design of MOSFET driver circuit for H-bridge
7. Construction and testing of inverter using Semikron intelligent power Module
8. Performance comparison of IM and PMSM drive
9. Microcontroller based PWM generation techniques
10. Power quality measurement of electrical appliances

Total P: 60

REFERENCE:

1. Department of Robotics and Automation Engineering, "Power Electronics and Drives Laboratory Manual", 2019.

19IR 611 AI AND VISION SYSTEMS LABORATORY

0 0 4 2

1. Image Basics and Video Handling Using OpenCV API
2. Parallel Programming Using CUDA C
3. POSE Estimation Using Monocular and Stereo Camera
4. Scan Matching and 3D Reconstruction Using RGBD Cameras
5. Geometric Transformation and Filtering Using OpenCV & CUDA C
6. Object Detection and Reconstruction Using CNN
7. Visual SLAM using Stereo Cameras With Deep Learning Libraries
8. Simulating Deterministic Local and Global Path Planning Algorithms
9. Simulating Stochastic Path Planning Algorithms
10. Design of Autonomous Mobile Robo

Total P: 60

REFERENCE:

1. Department of Robotics and Automation Engineering, "AI and Vision Systems Laboratory Manual", 2019.

ANNEXURE

19IH 071 INDIAN LANGUAGE

2 1 0 3

@ Students will demonstrate their proficiency in any one Indian language (e.g. Tamil, Hindi, Telugu, etc.) through a comprehensive examination.

19IZ 214 PROFESSIONAL SKILLS

6 0 9 2

UNIT I A: HISTORICAL PERSPECTIVE OF MANUFACTURING ENGINEERING: Industrial revolution, purpose and evolution of production engineering, materials in manufacturing, conscious design & manufacturing, economics - time and cost analysis, recent technologies - digital manufacturing, case studies. (L: 8)

UNIT I B: TRAINING IN CAD PACKAGE:
Solid modeling and assembly practice, Extraction of 2D view from 3D modeling, Coloring and shading of 3D models. (L: 8 P: 16)

UNIT II: SEMINAR PRESENTATION AND TECHNICAL REPORT WRITING

WRITING COHERENT PROJECT REPORT: Overview structure of reports, gathering informations - synopsis / abstract - title – headings – table of contents – list of figures – list of tables – list of appendices – chapters – structured paragraphs – inferences, conclusions – figures – tables – flow charts – complete design (headers and footers).-Plagiarism. Each student will be required to submit a technical report based on the guidelines provided by the department. (L: 8 P: 6)

PROJECT PRESENTATION: Each student will be required to make one technical presentation for a minimum 15 minutes duration in this course. Individual topics will be assigned to the students by the department. (P: 6)

PROFESSIONAL COMMUNICATION –ORAL SKILLS: Principles of group communication, interviewing, and making presentations- group discussions, role plays, mock interviews- talking about some visual information- giving and receiving instructions. (P: 8)

Total: L: 24+P: 36=60

19IZ 215 INTERNSHIP – SUMMER TRAINING

6 0 9 2

VISIT TO A PUMP INDUSTRY: Introduction, Bill of materials of an industrial pump, component suppliers, process flow – precedence diagram, manufacturing methods, product testing, production planning and quality assurance. (15)

VISIT TO AN AUTO ANCILLARY INDUSTRY: Introduction, organization structure, roles and responsibilities, cross functional teams, quality systems – control charts, ISO/TS 16949, continuous improvement – 5S, TPM, Kaizen and Poka-yoke. Occupational safety and health – Case studies. (15)

STUDENT – INDUSTRY EXPERT INTERACTION: Product design, development and testing / Industrial automation – Low cost automation / Shop floor best practices / Process planning / Production planning and inventory management, etc. (15)

NOTE:

- Visits to two local industries and one industry expert guest lecture are mandatory.
- For industrial visits, a Pre-visit and a post-visit questionnaire will be used for evaluation of students.
- Week wise activity plan indicated below will be used.

ACTIVITY PLAN

ACTIVITY	NO. OF WEEKS
Pre-visit presentation about the Industry no.1 (by the faculty) and questionnaire to be answered by the students.	1
Visit to industry 1	1
Batch wise observation report and presentation for Industry 1	2
ACTIVITY	**NO. OF WEEKS**
Post-visit written test (CA 1)	1
Pre-visit presentation about the Industry no.2 (by the faculty) and questionnaire to be answered by the students.	1
Visit to industry 2	1
Batch wise observation report and presentation for Industry 2	2
Post-visit written test (CA 1)	1
Industry expert talk	1
Batch wise group discussion on the topics from the expert talk	1
Viva-voce exam based on industries visited and expert talk.	2
TOTAL NO. OF WEEKS	**14**

Total = P: 45 = 45

REFERENCES:

1. Industrial Visit Manual prepared by Department of Mechanical Engineering.
2. William K Dalton, Gregg Bruce.R, “Modern Materials and Manufacturing Processes”, Pearson Education, 2007.
3. Askin.R.G and Goldberg.J.B, “Design and Analysis of Lean Production Systems”, John Wiley and Sons Inc., 2003.

19IH 072 AMERICAN HISTORY

2 1 0 3

Unit – I Western civilization - A brief survey of ancient and medieval civilizations followed by extensive treatment of the ascendancy of early mordern western civilization.

Unit – II Spread of western civilization – social, economic and political revolutions.

Unit – III Discovery of America – colonization – American war of independence.

Unit – IV History of the United States – major political, social cultural and economic changes.

Unit – V Jacksonian Democracy – Abraham Lincoln and civil wars – Reconstruction.

Unit – VI Western Front – Effects of first world war and its impact on socio-cultural economical and political front.

Unit – VII The great economic depression – second world war.

Reference

1. Charles A. Bear & Mary R Beard., “New Basic History of the United States”, DoubleDay & Company, New York, 1968.
2. Edwin Fenton &Allan O. Kownslar, “The Americans”,Holt, Rinehart & Winston, INC, New York,1975.

3. Henry Bamford Parkes, “The United States of America A History”, Scientific Book Agency,Calcutta, 1969.
4. Miller (Douglas T)., “The Birth of Modern America”, Bobbs–Merril Company, INC, Publisher, Indian Apolis, Indiana, 1975.
5. Robert K Carr & Marver H Bernstein., American Democracy, Dryden Press, Illinois,1977.

19IH 073 ORGANIZATIONAL BEHAVIOR

Introduction to OB: Meaning & Importance of OB – Historical Development & Contributing Disciplines (3)

Personality – Personality determinants & attributes, Emotional Intelligence and Work Values (5)

Employment relationship and the psychological contract (2)

Motivation - Basic Concepts, Motivation Theories, Problems in Motivation (5)

Leadership - Theories of leadership, Leadership styles and effectiveness (4)

Group Dynamics: Types of Groups, Group Norms and Cohesiveness: Group Roles. (4)

Organizational Culture - Elements, Culture and Performance, merging organizational cultures, changing and strengthening culture. (4)

Organizational Change - Forces for change force field analysis model Organization Development (4)

Work Stress - Causes and consequences – Stress coping strategies (4)

Case studies (7)

Total 42

REFERENCES:

1. Mc Shane Von Glinow and Radha Sharma, “Organisational Behaviour”, Tata Mc Graw Hill, 4th Edition, 2008
2. Stephen P Robbins, “Organisational Behaviour”, Prentice Hall (India) Pvt. Ltd., New Delhi, 13th Edition, 2009
3. Kreitner Robert, Kinicki , Angelo, “Organsiational Behaviour”, Irwin Inc., Illinois, 2nd Edition, 2006
4. Hellriegel, “Organsiational Behaviour” Thomson Learning, 1st edition, 2005
5. Ivancevich, “Organsiational Behaviour” Tata Mc Graw Hill, 7th Edition, 2006.

19IH 074 TOEFL / IELTS TRAINING

6 0 0 9