Diploma Instrumentation Engineering Syllabus Structure and Details (July 2020 onwards)

Course No.	Course Name	L	T	P	C	Course No.	Course Name	L	T	P	C
	Semester I						**Semester II**				
DHSS101	Communication in English	3	0	0	6	DHSS271	Communication in English Lab	0	0	2	2
DCH102	Chemistry-I (THEORY)	2	1	0	6	DCSE202	Computer Fundamentals & Programming	2	0	0	4
DCH172	Chemistry-I (PRACTICAL)	0	0	2	2	DCSE272	Computer Fundamentals & Programming Lab	0	0	2	2
DMA103	Mathematics-I	3	0	0	6	DEE203	Fundamentals of Electrical & Electronics Engineering	2	1	0	6
DME104	Engineering Drawing	2	0	0	4	DEE273	Fundamentals of Electrical & Electronics Engineering Lab	0	0	2	2
DME174	Engineering Drawing Lab	0	0	2	2	DMA204	Mathematics-II	3	1	0	8
DME176	Workshop Practice	0	1	4	6	DME205	Engineering Mechanics	3	0	0	6
DPH105	Applied Physics - I (THEORY)	2	1	0	6	DPH206	Applied Physics – II	2	1	0	6
DPH175	Applied Physics - I (PRACTICAL)	0	0	2	2	DPH276	Applied Physics - II (PRACTICAL)	0	0	2	2
Contact Hours: 25		**12**	**3**	**10**	**40**	**Contact Hours: 23**		**12**	**3**	**8**	**38**
	Semester III						**Semester IV**				
DMA301	Mathematics-III	3	0	0	6	DEE401	Electrical Machines	2	1	0	6
DHSS302	Engineering Economics and Accountancy	3	1	0	8	DEE471	Electrical Machines Lab	0	0	2	2
DIE301	Electrical Circuits and Networks	2	1	0	6	DIE401	Electronics Devices and Circuits-II	2	1	0	6
DIE371	Electrical Circuits and Networks Lab	0	0	2	2	DIE471	Electronics Devices and Circuits-II Lab	0	0	2	2
DIE302	Electronics Devices and Circuits-I	2	1	0	6	DIE402	Transducers & Signal Conditioning	2	1	0	6
DIE372	Electronics Devices and Circuits-I Lab	0	0	2	2	DIE472	Transducers & Signal Conditioning Lab	0	0	2	2
DIE303	Fundamentals of Instrumentation	2	1	0	6	DIE403	Microprocessor	2	1	0	6
DIE304	Digital Electronics	2	1	0	6	DIE473	Microprocessor Lab	0	0	2	2
DIE374	Digital Electronics Lab	0	0	2	2	DIE404	Control Systems	2	1	0	6
						DIE474	Control Systems Lab	0	0	2	2
Contact Hours: 25		**14**	**5**	**6**	**44**	**Total Contact Hours 25**		**10**	**5**	**10**	**40**
	Semester V						**Semester VI**				
DEE511	Generation Transmission & Distribution of Power	2	1	0	6	DEE611	Substation Switchgear and Protection	2	1	0	6
DIE501	Process Control	2	1	0	6	DHSS601	Industrial Management and Entrepreneurship	3	0	0	6
DIE571	Process Control Lab	0	0	2	2	DIE601	Industrial Instrumentation-II	2	1	0	6
DIE502	Industrial Instrumentation-I	2	1	0	6	DIE671	Industrial Instrumentation-II Lab	0	0	2	2
DIE572	Industrial Instrumentation-I Lab	0	0	2	2	DIE602	Biomedical Instrumentation	2	1	0	6
DIE503	Electrical & Electronic Measurements	2	1	0	6	DIE672	Biomedical Instrumentation Lab	0	0	2	2
DIE573	Electrical & Electronic Measurements Lab	0	0	2	2	DIE611	Industrial Automation	2	1	0	6
DIE504	Power Electronics	2	1	0	6	DIE691	Project	0	0	10	10
DIE574	Power Electronics Lab	0	0	2	2						
DIE511	Telemetry	2	1	0	6						
Total Contact Hours 26		**12**	**6**	**8**	**44**	**Total Contact Hours 29**		**11**	**4**	**14**	**44**
Total Mandatory Credits: 250											

Semester I

Paper code: DCH102
Paper name:Chemistry-I(Theory)   **Credit:6**
Total contacthours:40   **L-T-P:2-1-0**

Unit I: Periodic table,Atomicstructure   (4L)

Electrons, protons, neutron, Atomic mass (A), atomic number (Z) isotopes, isobars, isotone, orbit and orbitals, electronic configuration (upto Z=30). Modern periodic table, groups and periods.

UnitII:Electrochemistry   (5L)

Electrolytes, Faraday's law of electrolysis, Numerical problems, application of electrolysis, oxidation and reductions, Redox reactions.

UnitIII:Metallurgy   (5L)

General principles of metallurgy, minerals, ore, gangue, slag, flux, roasting, calcination etc. Metallurgy of iron and alluminium, Manufacture of steel by Bessemer process, open hearth process and LD process, alloys.

UnitIV:Bulidingmaterials   (3L)

Portland cement, Types of manufacturing, setting and hardening of cement, special cement. Glass, Bricks.

UnitV:Lubricant   (3L)

Defination, classification of lubricants, important functions of lubricants.

Unit VI: Polymerandpolymerization   (4L)

Types of polymer, thermoplastic and thermosetting plastic, preparation and applications of PE, PVC, PP, Perpex, Teflon, Bakelite, nylon, Natural rubber, Synthetic rubber.

Unit VII:Organicchemistry   (6L)

IUPAC nomenclature, Alkane, alkene, alkyne, alcohol synthesis and applications.

Unit VIII:EnvironmentalChemistry   (6L)

Defination, Types of pollution, pollutants, Water quality measurements- D.O, B.O.D, C.O.D, hardness of water, removal of hardnes, TDS, Green house effect, acid rain, Ozone layer depletion.

Unit IX:Industrialchemistry   (4L)

Ethanol manufacture from starch by fermentation, Fuels- Classifications, calorific values, natural gas, water gas, producer gas, LPG, power alcohol. Petroleum- refining, octane number, cetane number.

Texts-Books / References:
1. S. Chawla;*A Text Book of Engineering Chemistry*, DhanpatRai PublishingCo.
2. Jain and Jain;*Engineering Chemistry*, DhanpatRai PublishingCo.
3. 3.V.R. Gowariker, N.V. Viswanathan, J. Sreedhar, *PolymerScience*, New AgeInternational Publisher.
4. S.K. Ghosh Advanced General OrganicChemistry (A Modern Approach) (Set I & Ii) NCBA Publisher, New Delhi,2009

5. B. Viswanathan, P. S. Raghavan; Practical Physical Chemistry, Viva
6. 6.Dr. S. Rattan; Experiments in Applied Chemistry, S. K. Kataria&Sons.
7. J.C. Kuriacose and J. Rajaram; *Chemistry in Engineering*, Tata McGraw-Hill Publishing Company Limited, NewDelhi
8. Dr. S. Rabindra and Prof. B.K. Mishra ;*Engineering Chemistry,* Kumar and Kumar Publishers (P) Ltd.Bangalore-40
9. SS Kumar; *A Text Book of Applied Chemistry-I* , Tata McGraw Hill,Delhi
10. Dr. G.H. Hugar; *Progressive Applied Chemistry –I and II* , EaglePrakashan
11. M. L. Sharma, P.N. Chaudhury, B. R, Khanal, D.R.Paudel; *Engineering Practical Chemistry*, Ekta Books Distributors.

Paper code: DCH172
Paper name:Chemistry-I(Practical)   **Credit:2**
Total contacthours: N/A   **L-T-P:0-0-2**

Experiment-1: Introduction to chemistry laboratory, precautions, name of common chemicals, apparatus, instruments etc.
Experiment-2: Volumetric analysis and study of apparatus used therein.
Experiment-3: Determine the degree of temporary hardness of water by EDTA titration.
Experiment-4: Determination of solubility of a solid at room temperature.
Experiment-5: To verify the first law of electrolysis (electrolysis of copper sulphate solution using copper electrode).
Experiment-6: Determination of pH of unknown solutions.
Experiment-7: To determine the coefficient of viscosity of the alcohol by using *Ostwald's* viscometer.
Experiment-8: To determine the surface tension of the given liquid with respect to water at room temperature by using *Stalagnometer*.
Experiment-9 Preparation of standard solution of Na_2CO_3
Experiment-10 Determination of strength of NaOH by titrating with 0.1 N HCL

Paper name: Applied Physics – I (Theory)
Papercode: DPH105   **Credit: 06**
Total contact hours:36hours   **L-T-P: 2-1-0**

Module 1: UNITS&DIMENSION   **Contact hours: 2**

    1.1. Need of measurement and Unit in Engineering and Science definition of unit, fundamental and derived quantities and their units, different system of units (CGS and SI), Illustrations.

    1.2 Explanation of dimensions of physical quantities, dimensional equations of physical quantities and their uses withexamples.

Module 2:BASICMECHANICS   **Contacthours:12**

    2.1 Introduction to scalar and vector quantities,representationof vector, addition, subtraction and multiplication of vectors, parallelogram law of vector addition, resolution of vector, dot and scalar product of two vectors (details notrequired).

    2.2 Newton's laws of motion: First law, explanation, definition of force,Conceptof Inertia, types of inertia (inertia of rest and inertia of motion), Newton's second law, momentum, impulse, mass & weight, simple problems, Newton's third law, explanation and itsexamples,Principle of conservation of linear momentum, statement and simple examples (e.g. recoil of a gun), numerical problems.

    2.3 Circular motion, time period and angular velocity, relation between angular velocityand

linear velocity, centripetal and centrifugal force, bending of a cyclist on a curved path, banking of roads and railway track, numerical problems.

2.4 Work, power and energy, its concept, units and dimension, Potential and Kinetic energy, its mathematical relations, Principle of conservation of energy, its proof in case of a free falling body under gravity, numerical problems.

2.5 Simple Harmonic Motion, its geometrical representations and 1 derivation of its equations, definition of amplitude, time period, frequency, phase etc., mathematical relations and units, simple pendulum & second's pendulum, numerical problems.

Module 3: GRAVITYANDGRAVITATION   Contacthours:3

3.1 Newton's law of gravitation, acceleration due to gravity, relation between 'G' and 'g', their units, variation of the value of g with altitude and depth, Centre of gravity and Centre of mass, Numerical problems

Module 4: ELASTIC PROPERTIES OF SOLID Contact hours:3

4.1 Deforming force, restoring force, Elastic and plastic bodies, explanation of stress and strain with their types, Hook's law, elastic limit, Young's modulus, Bulk modulus, Rigidity modulus, Poisson's ratio, their units and numerical problems.

Module 5: HEAT AND THERMODYNAMICSContact hours:10

5.1 Concept of heat and temperature, thermometer, different scales of temperatures and their conversion formulae, numerical problems.

5.2 Thermal expansion: expansion of solid, linear, superficial and cubical expansion of solid, their coefficients & their relations; Expansion of liquid: co-efficient of Real and Apparent expansion, their relation, variation of density with temperature, Anomalous expansion of water (experimental determination not necessary). Concept of Absolute scale of temperature.

5.3 Calorimetry: Unit of heat, Joule and calorie, Specific heat, thermal capacity and water equivalent.

5.4 Change of state of a body, melting and freezing point, effect of pressure on melting point, latent heat, Evaporation, difference between vaporisation and evaporation, factors on which rate of evaporation depends.

5.5 Transmission of heat, three modes of heat transfer, conduction, convection and Radiation, good and bad conductor of heat, coefficient of thermal conductivity, its S.I. unit and dimension.

5.6 1st law and 2nd law of thermodynamics, Joule's law and Mechanical equivalent of heat.

Module 6: SOUNDContact hours:6

6.1 Wave Motion: amplitude, time period, frequency and wavelength, relation between velocity, frequency and wavelength. Transverse and longitudinal waves with examples.

6.2 Propagation of sound wave: Expression of velocity of sound in air, Newton's formula and Laplace's correction, Effect of temperature, and pressure on velocity of sound.

6.3 Audible range, ultrasonic and infrasonic sound, application of ultrasonic sound to calculate the depth of ocean.

6.4 Reflection of sound and its application, Echo and reverberation of sound, acoustic of building

6.5 Doppler's effect with Mathematical expressions.

Books / References:

1. Modern Approach to Physics Part I & II, DilipSarma, N G Chakraborty, and K NSharma,

Kalyani Publisher, New Delhi.
2. Applied Physics Part I & II, Manpreet Singh, Dr. Major Singh, and Mrs. Hitashi Gupta,
S K Kataria& Sons- NewDelhi.
3. Basic Applied Physics, R K Gaur, DhanpatRai Publication- NewDelhi.

Paper name: Applied Physics-I (Practical)
Paper code: DPH175   **Credit:02**
Total contact hours:18hours   **L-T-P: 0-0-2**

1. VernierCallipers: To determine the volume of a metallic/woodencube.
2. Screw Gauge: to determine cross sectional area of a wire/ thickness of a glasspiece.
3. Spherometer: To determine the radius of curvature of concave and convexmirrors.
4. To determine the value of acceleration due to gravity (g) of a place with simplependulum.
5. To measure the velocity of sound in resonancetube.
6. To determine the frequency of a tuning fork usingSonometer.
7. Measurement of Specific gravity of solid, liquid, using Nicolsonhydrometer,
   Hare's apparatus and specific gravity bottles.
8. To determine the atmospheric pressure by using Boyle's lawapparatus.
9. To determine water equivalent of a calorimeter by method ofmixture.

Paper code: DMA103
Papername:Mathematics-I   **Credit:6**
Total contacthours:35   **L-T-P:3-0-0**

Module–I:ALGEBRA   **(20 HOURS)**

- Vector and Scalar quantities – types of vectors, geometric representation of vectors, addition and subtraction of vectors, magnitude of a vector, product of a vector by a scalar, Module vectors i, j, k.
- Arithmetic and geometric progressions – nth term of A.P. and G.P., Geometric mean between twonumbers.
- Complex numbers – origin, general form, polar form, examples. Simpleproblems.
- Binomial theorem – Factorials, positive integral values, binomial expansion, rules, calculation of appropriatevalue.
- Logarithm and exponentialseries.
- Determinants: Definition, operations and Cramer's rule for solving simultaneous linear equations.
- Basic concepts of permutation andCombinations.

Module-II:TRIGONOMETRY   **(15HOURS)**

- Trigonometric functions andratios.
- Trigonometric functions of allied angles – half, double, triple, compoundangles.
- Addition and subtractionformulae.
- Solution of triangles usingproperties.
- Simplification of trigonometric expressions using differentformulae.
- Basic concept of inverse trigonometric functions and hyperbolicfunctions.

Reference Books:

Sl. No.	Title	Author/ Publisher

1	Mathematics for Polytechniques: Vol – I&II	TTTI, Bhopal
2	Mathematics for Polytechniques	S.P. Deshpande
3	Engineering Mathematics	I.B. Prasad
4	Engineering Mathematics	Grewal
5	Plain Trigonometry	Bansilal
6	College Algebra	Shah and Desai
7	Mathematics Textbook for class XI and XII	NCERT

Paper code:DHSS101   **Credit:6**
Paper name: COMMUNICATIONINENGLISH   **L-T-P: 3-0-0**
Total contact hours:39

Module 1: Parts ofSpeech 1.1 Recognition and review of Nouns, Pronouns, Verbs, Adverbs, Adjectives,Prepositions, Conjunctions,Interjections 1.2 Knowledge of Subject, Object and Compliment of theVerb 1.3 Herbals –Infinitival, Gerund andPreposition. .	**Contact hours: 3**
Module 2: Prepositions of time and place 2.1 Contextual teaching of prepositions of time - on, in , at, since, for, ago, before, to, past, to, from, till/until,by 2.2 prepositionsofplace:in,at,on,by,nextto,beside,near,between,behind,infrontof, under, below, over, above, across, through, to, into, towards, onto,from.	**Contact hours: 5**
Module 3: Clause, phrases and Relative Clauses 3.1 Basic definitions of clauses andphrases 3.2 Focus on Relative Pronouns and their use in sentences as relativeclauses.	**Contact hours: 2**
Module 4: Subject Verb Agreement 4.1 Rules that guide the agreement of the subject to its verb	**Contact hours: 5**
Module 5: Sentence types and Transformation of sentences 5.1 Assertive sentences, Exclamatory sentences, Interrogative sentences, Negative sentences, Compound sentences, complex sentences, simple sentences, Degrees of Comparison.	**Contact hours: 5**
Module 6 Voice 6.1 Change from Active Voice to Passive Voice and vice versa	**Contact hours: 3**
Module 7: Punctuation 7.1 Use of the comma, semi-colon, colon, apostrophe, exclamation mark, question mark and quotation marks	**Contact hours: 5**
Module 8: Word formation 8.1 Change of one part of speech to the other: from Verbs to Nouns, Nouns to Verbs, Adjectives to Nouns, Nouns to Adjectives, Verbs to adverbs, and Adverbs to Verbs	**Contact hours: 2**
Module 9: Affixation 9.1 Prefixes and Suffixes and new word formations	**Contact hours: 2**
Module 10: Nominal Compounds 10.1 Common nominal compound	**Contact hours: 2**
Module 11: Paragraph Writing 11.1 Descriptive Paragraph on various related topics.	**Contact hours: 5**

BOOKS RECOMMENDED: 1. Essential English Grammar with Answers by Raymond Murphy (Cambridge University Press)
2. English for Polytechnics by DrPapori Rani Barooah (Eastern Book HousePublishers)
3. English Grammar by Annie Brinda (Cambridge UniversityPress)

Paper codes: DME104 / DME174
Paper name: Engineering Drawing / Engineering Drawing Lab
DME104 → L-T-P-C: 2-0-0-4
DME174 →L-T-P-C:0-0-2-2   **Total contact hours= 48**

Module1.INTRODUCTION   [Contact Hrs: 5 Hrs]
  i.   Drawing as a medium ofcommunication,
  ii. Use and care of Drawing InstrumentsAssignments:
            Such as Drawing of Horizontal and Vertical Lines, Square, Rectangle,
            Mosaic Pattern, Angular Pattern, Stamping with circular pattern.
  iii. Types of Lines and Dimensioning as per15696/72

Module 2.GEOMETRICALCONSTRUCTIONS   [Contact Hrs =8Hrs.]
  i.   Freehand curves, free hand Drawing
  ii. Construction of triangles, Perpendicular and angles of 300, 450, 600,900
  iii. Construction of Regular Polygons..
  iv. Regular Polygons inscribed incircles.
  v.   Regular figures by using T – square and Set –square.

Module 3.LETTERING,SCALES   [Contact Hrs = 5Hrs.]
  i.   Single Stroke Lettering Straight and Inclined by graph and Free hand Letters and digits as per 15696/72
  ii. Scale- Representative Fraction, Types orScales
  iii. Simple problems on Plain and DiagonalScale
        .
Module 4. PROJECTIONOF POINTS   [Contact Hrs = 5Hrs.]
  i.   Position / location of Points, Horizontal plane, Vertical plane.
  ii. Assignments of Simple problems on different quadrants and Find the distance between twopoints.
  iii. Position/ Location ofPoints.

Module 5. PROJECTIONOF LINES   [Contact Hrs = 5Hrs.]
  i.   Position / location of Points, Horizontal plane, Vertical plane.
  ii. Assignments of Simple problems on different quadrants and Find the distance between twopoints.
  iii. Position/ Location ofLines.

Module 6.ORTHOGRAPHICPROJECTION   [Contact Hrs = 5Hrs.]
  i.   Top View, Front View and Side View of Simple objects, block and machine parts with dimensional scale.
  ii. Sectional Front ,Top and Side Views As per IS – 696 for simple parts and blocks.

Module 7. RIVET HEADSANDJOINTS   [Contact Hrs = 5Hrs.]
  i.   Different types of Rivet Heads andJoints.
  ii. Top and Sectional Front views of Lap and Butt Joints with single double coverplates.

Module 8.ISOMETRICPROJECTION   [Contact Hrs = 5Hrs.]
  i.   Isometric Projection to true scale and isometricscale.

Module 9.THREAD/ SCREWED   [Contact Hrs = 5Hrs.]
   i.   Thread Profiles (REF IS 2043 IS – 554 ETC.)
  ii.   ScrewedFastenings
 iii.   Representation of external and internal threaded assembly symbolic.
  iv.   Representation ofthreads.
   v.   Representation of Screws, Bolts, Nuts andCutter.

Reference Books :
1. Elementary Engineering Drawing [Plane and Solid Geometry] By N.D. Bhatt, V.M.Panchal.
2. Geometrical and Machine Drawing By N.D.Bhatt

Paper code: DME176
Paper name:WorkshopPractice   **L-T-P-C: 0-1-4-6**
Total contact hours =60

Module 1: Carpentry shop(Theory and Practice: 12hrs)
            1.1 Introduction with theshop
            1.2 Various structure of wood and types ofwood
            1.3 Different types of tools, machine and accessories used in Carpentryshop
            1.4 Safety Precautions in workshop
            Details of Practical Contents (3+3hrs)
            Demo of different wood working tools and machines
            Demo of different wood working processes
            Simple joints like T joints etc.
            One simple utility job.

Module 2:Fitting Shop   (Theory and Practice:12hrs)
            2.1 Introduction with the fittingshop
            2.2 Various marking, measuring, cutting, holding and strikingtools
            2.3 Different Operations like chipping, filing, marking drillingetc.
            2.4 Working principle of drilling machine, lapping dies etc.
            Details of Practical Contents (3+3hrs)
            Demo of different fitting tools and machines and power tools
            Demo of different processes in fitting shop
            Squaring of a rectangular metal piece
            One simple utility job.

Module 3:Welding Shop   (Theory and Practice: 12hrs)
            3.1 Introduction
            3.2 Types of Welding, Arc Welding, Gas Welding, GasCutting
            3.3 Welding of dissimilar materials, selection of welding rod material, size of rod and work
            piece
            3.4 Different types offlames
            3.5 Elementary symbolic Representation
            3.6 Safety andprecautions
            Details of Practical Contents (3+3 hrs)
            Demo of different welding tools and machines
            Demo of Arc Welding, Gas Welding, Gas Cutter and rebuilding of broken parts with welding
            Any one Composite job involving lap joint welding process.

Module 4:MachineShop   (Theory and Practice: 12hrs)
            4.1 Introduction
            4.2 Study of Different types of Lathe machine, shaping machine, Drillingmachine

4.3 Study of Different types of hand tools and machine tools andparts
4.4 Safety &precautions
Details of Practical Contents (3+3 hrs)
Demo of different machines and their operations
Preferably prepare a simple job.

Module 5Turningshop (6 hrs)

Demo of lathe machine, drilling machine
One job related to plane and taper turning , threading and knurling
One job related to drilling and tapping

Module 6ElectricalShop (6 hrs)

Demo of simple house wiring and use of tools
One job related to simple house wiring
Fittings of cut outs, fuses and other simple fittings etc.
Difference between Single phase wiring and three phase wiring

Suggested Text/Reference Books:

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

Paper name: Applied Physics – II (Theory)
Papercode:DPH206   **Credit:06**
Total contact hours:36hours   **L-T-P: 2-1-0**

Module 1: LIGHT Contact hours: 5

1.1   Reflection, Reflection on spherical mirror, idea of real and virtual image, mirror formula, sign conventions (mirror formula to be assumed), nature size and position of images of different positions of objects, numericalproblems.

1.2   Refraction, refractive index, critical angle, total internal reflection, between critical angle and refractive index, Prism, refraction through prism, minimum deviation, numerical problems. Lens, refraction through lens (lens formula to be assumed of a lens), numericalproblems.

Module2:ELECTROSTAICS   Contact hours: 3

2.1 Concept of Electric charge according to modern electron theory, unit of charge, Inverse square law, electric field, Electric line of force, electricintensity

2.2 Potential at a point due to a point charge, relation between intensity and potential with deduction of theformula

2.3 Capacity of a condenser, series and parallel combination, different type of condenser, numerical problems.

Module 3:CURRENTELECTRICITY   Contact hours:11

3.1 potential difference and electric current with their units.

3.2 Difference between emf. and potential difference; internal resistance of cell. Voltaic cell; defects of cell: local action and polarization and theirremoval.

3.3 Difference between primary and secondary cells with examples, grouping of cells, series, parallel and mixed combinations of cells.

3.4 Basic D.C. Circuits: Ohm's Law and its verification, mathematical expression, Kirchoff's Law, numericalproblems.

3.5 Definition of resistance, conductance, effects of temperature on resistance, Series and parallel combination of resistance, resistance per unit length, numericalproblems.

3.6 Heating Effect of Current: Joule's law, electricity energy and power, numericalproblems

3.7 Thermoelectric effect: Thermocouple, Seebeck effect, Peltier effect and Thomsoneffect.

3.8 Chemical effect of current: electrolysis, Faradays's laws ofelectrolysis.

Module4:MAGNETISM   Contact hours: 5

4.1 Nature and artificial magnets theories, different types of magnets, induced magnetism, nature of polarities.

4.2 Inverse square law, magnetic intensity at end – on and broad– side on position, uniform and non – uniform field, magnetic moment, couple on a magnet in a uniform field, Tangent law.

4.3 Elements of terrestrialmagnetism

Module 5: ELECTROMAGNETISM Contact hours: 4

5.1 Magnetic effect of current, nature of magnetic field due to straight and circular conductor, due to solenoid, Fleming's left and right hand rules, effect of current following through two parallel conductors.

5.2 Electro Magnetic induction: e. m. f. induced in a coil due to magnet, Faraday' s laws of electro – magnetic induction, Lenz Law, self and mutual induction.

Module 6: MODERN PHYSICS   Contact hours: 4

6.1 Photo Electric Emission: explanation and demonstration of photo electric current, photo electric equation with its physical signification.

6.2 Nuclear Energy: Atomic mass unit, mass energy equivalence, mass defect

6.3 X- rays: Properties and its application in industry (Production apparatus not necessary)

6.4 Radio –activity: Natural and artificial radioactivity, emission of alpha, beta and gamma radiation, their properties and uses.

Module 7: ELECTRONICS   Contact hours: 2

7.1 Thermionic emission: vacuum tube, diode and triode, their working principle, concept of rectifier and amplifier, use of diode as rectifier.

Module 8: SEMI –CONDUCTOR PHYSICS   Contact hours: 2

8.1   Concept of semiconductors, properties and basic principle, intrinsic and extrinsic semiconductor, p-type and n-type semiconductor.

Suggested Reference books.

1. Modern Approach to Physics Part I & II, DilipSarma, N G Chakraborty, and K N Sharma, Kalyani Publisher, NewDelhi.
2. Applied Physics Part I & II, Manpreet Singh, Dr. Major Singh, and Mrs. Hitashi Gupta, S K Kataria& Sons- NewDelhi.
3. Basic Applied Physics, R K Gaur, DhanpatRai Publication- NewDelhi

Paper name: Applied Physics-II (Practical)
Paper code: DPH276   **Credit: 02**
Total contact hours: 20 hours   **L-T-P: 0-0-2**

1. To verify the laws of reflection using a plane mirror and to study the characteristics of image formed.
2. To determine the refractive index of the material of the glass slab by pin method.
3. To determine the focal length of a convex lens by U-V method.
4. To determine the focal length of a convex lens by plane mirror method.
5. To draw I-D curve and to determine the refractive index of the material of a prism.
6. To locate the poles of a bar magnet and to measure the magnetic length.
7. To plot magnetic lines of force of a bar magnet with north pole pointing north and to locate the neutral point/to plot magnetic lines of force of a bar magnet with south pole pointing north and to locate the neutral point.
8. To verify Ohm's law by Ammeter-voltmeter method.
9. To find equivalent resistance using voltmeter with I. Three resistances connected in series II. Three resistances connected in parallel.
10. To measure the unknown resistance of the material of a wire by meter bridge using Wheatstone bridge principle.

Paper name: Mathematics – II
Papercode:DMA204   Credit:08
Total contact hours:40hours   L-T-P:3-1-0

MODULEI: CALCULUS-I   (16 HOURS)
   a. **DifferentialCalculus**
   - Sets: Definition, types and operation onSets.
   - Relation: Definition, domain and range, equivalencerelation.
   - Functions: definition, types offunctions.
   - Limits: Concept and evaluation of limits, indeterminate forms, L'Hospital's Rule.
   - Differentiation: Differentiation by first principle. Differentiation of sum, product and quotient, function of function, Chain rule. Differentiation of trigonometric, inverse trigonometric, hyperbolic, logarithmic and parametric functions, applications.
   - Basic concepts of partialdifferentiation.

   b. **IntegralCalculus**
   - Integration: Definition and fundamentalproperties.
   - Methods of integration – integration by substitution, by parts, partial fractions
   - Applications

MODULE-II:STATISTICS   (10 HOURS)
   - Measures of Central Tendency: Mean,Median and Mode and empirical relationship between them and relatedproblems.
   - Measures of Dispersion: Range, Mean Deviation, Standard Deviation, Quartile deviation.
   - Correlation

MODULE-III:CO-ORDINATEGEOMETRY   (14 HOURS)
   - Co-ordinate Systems, Cartesian and polar co-ordinates, distance between two points, section formula, area of triangle, collinearly andco-planarity.
   - Straight Line: Definition, general and standard form of equations, intersection of straight lines: angle between them, bisector of angle betweenthem.
   - Change of co-ordinate axes, shifting of origin and rotation ofaxes.
   - Circle: Standard equations and simple problems, tangent andnormal.
   - Basic idea of parabola, ellipse and hyperbola, their standard equations and basicproperties.

Books for Reference:-

Sl. No.	Name of the books	Author/Publisher	Edition/Year
1.	Mathematics for Polytechniques	TTTI, Bhopal	Latest
2.	Mathematics for Polytechniques	S. P. Deshpande	Latest
3.	Engineering Mathematics	I.B. Prasad	Latest
4	A text Book Matrices	Shanti Narayan, S. Chand & Co. NewDelhi	1998
5	Introduction to Statistics	L. Choudhury, KitapGhar, Guwahati.	Latest
6	Fundamental of Statistics	Kapoor & Gupta	Latest
7	Mathematics Textbook for class XI and XII	NCERT	Latest

Paper code: DME205
Paper name:EngineeringMechanics   L-T-P-C: 3-0-0-6
Total hours : 41hours

Module 1: ForcesandMoments   (12hrs)
Force, Moment and Couple, Resultant of forces, Forces in space. Equilibrium, FBD, General equations of equilibrium,

Module2:Friction   (8 hrs)
Introduction to dry friction. Laws of friction, friction of simple machines- inclined planes, Screw jacks.

Module 4: Center of gravity and momentofinertia   (8 hrs)
Center of gravity of axes, volume and composite bodies: Area moment of inertia and mass moment of inertia for plane figures and bodies.

Module5:Motion   (5 hrs)
Linear and circular motion, Linear and angular velocities and acceleration,Units relation in between centrifugal force, Its uses in Engineering problems. Angle of banking super elevation problems. Bodies moving on a level circular path, skidding, overturning.

Module 6: Work, Powerand Energy   (3hrs)
 Work, power and Energy definition and application, Potential and kinetic energy-definition and Units and their Engineering problems.

Module 7: SimpleLifting Machines   (5 hrs)
 Definition and importance of Simple Machines. Law of Machine, problems. Simple lifting Machines – simple Wheel and axle, differential wheel and axle and screw jack(simple) problems. Definition M.A, V.R and efficiency and their relationship. Simple problems

Reference books:
1.   Engineering Mechanics: S Timoshenko & D H Young. McGrow HillInt.
2.   Engineering Mechanics: R S Khurmi. S Chand &Co.
3.   Engineering Mechanics: R K Bansal. Laxmi Publication (P) Ltd
4.   Engineering Mechanics: K L Kumar. McGrow Hill Publishing Co.
5.   Irving H. Shames (2006), Engineering Mechanics, 4th Edition, PrenticeHall
6.   F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I –
Statics, Vol II, – Dynamics, 9th Ed, Tata McGrawHill
7.   R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and
Dynamics, PearsonPress

Paper code: DEE203
Paper name: Fundamentals of Electrical &ElectronicsEngineering   Credit: 6
Total contacthours: 34   L-T-P: 2-1-0

Module 1:   Contact hours:2L
Introduction: Sources of energy; General structure of electrical power systems, Power transmission and distribution via overhead lines and underground cables.

Module 2:   Contact hours:8L
DC circuits: Definitions of active, passive, linear, non-linear circuits elements and networks, Kirchoff's laws, Nodal and mesh analysis, voltage and current sources, network theorems, superposition. Thevenin's, Norton's, maximum power transfer, Millman's, and reciprocity theorems, analysis of simple circuits with DCexcitation.

Module 3:   Contact hours: 10L

Single phase AC circuits: generation of single phase sinusoidal EMF, instantaneous, average and effective value, form and peak factor, examples of other alternating waveforms and average and effective value calculations, concept of phasor and phasor diagrams, lagging and leading of phasors, pure resistive, inductive and capacitive circuits, power factor, complex power, R-L, R-C and R-L-C series circuits, parallel AC circuits, series and parallelresonance.

Module 4:   **Contact hours: 4L**
Semiconductor Devices:
Review of atomic structure, Intrinsic and Extrinsic semiconductors, current carriers in semiconductors, P-type and N-type materials, P-N junction, biasing, characteristic curve, load line, Zener diode.
Special semiconductor devices (Qualitative only) – tunnel diode, backward diode, varactor and PIN diode, their construction, operation and applications.

Module 5:   **Contact hours: 3L**
Bipolar transistor (Qualitative only): Construction and schematic representation of PNP and NPN transistors, formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors.

Module 6:   **Contact hours: 2L**
Bipolar transistor (Qualitative only):
Different types of biasing system, bias stabilisation, analysis of CE, CB & CC configuration, their I/P & O/P characteristics, transistor rating and specifications.

Module 7:   **Contact hours: 3L**
Rectifier Circuits:
Half wave and full wave rectifier (Qualitative only): ripple factor, rectification efficiency, Peak Inverse Voltage.
Filtering (passive) and voltage regulation (Qualitative only): Capacitor filter, Inductor filter, 'T' filter, 'π' filter. Zener as voltage regulator.

Module 8:   **Contact hours: 2L**
Cathode Ray Oscilloscope: Construction features of cathode ray tube, concept of dual beam CRO; application of CRO for different electrical measurements: amplitude frequency and phase of sine wave, Lissajous figure.

Books / References:

1. D.P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill,2009.
3. B.L. Thereja, A.K. Thereja, " A Textbook of Electrical Technology",S.Chand
4. Jacob Millman, "Electronics Devices & Circuits", McGraw Hill Education; 4 edition(2015).
5. Boyestad&Nashelsky, "Electronics Devices andcircuittheory",   Pearson Education India; 11th edition (2015).
6. S. Salivahanan& N. Suresh Kumar, "Electronic Devices and Circuits", McGraw Hill Education; Fourth edition (2017).
7. Albert Malvino& David Bates, "Electronic Principles", Tata McGraw Hill Publication,2010.
8. A.K. Maini, "Analog Circuits", Khanna Publishing House, Ed.2018.

Paper code: DEE273
Paper name: Fundamentals of electrical & electronicsengineeringlab   **Credit: 2**
Total contacthours:16   **L-T-P: 0-0-2**

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, rheostat andwattmeter.
2. Make a measured resistance from a givenrheostat
3. Verification of Kirchhoff'slaws
4. Verification of Superposition theorem
5. Verification of Thevenin'stheorem
6. P-NJunction
6. Half-wave rectifiercircuit
7. Full-wave rectifiercircuit
8. V- I characteristics oftransistors
9. Wiring

Paper code: DHSS271
Paper name: COMMUNICATION INENGLISHLAB **Credit:2**
Totalcontact hours:39 **L-T-P-C:0-0-2-2**

Module 1: Speaking and Listening practices 1.1 Practices of sounds ofEnglish 1.2 Proper Body language whilespeaking 1.3 Presentation and public speakingpractices 1.4 Practicing to enhance listeningskills 1.5 Different types ofistening 1.6 Good listeningpractices 1.7 Overcoming barriers to effectivelistening	
Module 1: Business Writing 1.1 Letter Writing Formal letterformats, 1.2 practice of letter writing in different situations: Order letter, Complaint letter, Letterof Adjustment, Quotation letter , Letter to the Editor, Application for leave ofabsence 1.3 Job Application and Cover Letter, format of a jobapplication 1.4 Resume, Curriculum Vitae, biodata.	**Contact hours: 3**
Module 2: Paragraph Writing and Summary Writing 2.1Definition, Cohesion and Linkage using Transition words on everyday topics 2.2. Practicing how to compose coherent passages. 2.3 Definition, Use of Transition words, important points to remember whilesummarizing 2.4 Explain and practicing how to arrive at a summary of a paragraph /text	**Contact hours: 5**
Module 4 Email Writing 4.1 writing the perfecte-mail, 4.2 steps to the perfect e-mail, formal and informal greetings, requests through an e-mail, writingan apology, complaint and seeking help and information in ane-mail, 4.3 informing about a file attached in in an email, writing the formal ending of ane-mail 4.3 Explaining and practicing how to write formal and informal emails	**Contact hours: 5**
Module 3: Report writing 3.1 Definition, types of reports with a focus on annual report, non-profit annual report, technicaland academicreport, 3.2 necessity and purpose of writing a report, qualities of a goodreport, 3.3 language used in areport, 3.4 different formats of reports and samplereports	**Contact hours: 2**
Module 5: Facing an interview 5.1 How to approach, what to speak, how to speak in an interview and answer interview questions,the business etiquettes tomaintain 5.2 body language, negative body language, handling an awkward situation in an interview, the dress code 5.3 Successful job interviewpractices 5.4 Perfect handshake, points to remember while applying for ajob	**Contact hours: 5**

Module 6 British English and American English	Contact hours: 3
6.1 Difference between American and British English words – vocabulary andspelling 6.2 Pronunciation andaccents	

BOOKS RECOMMENDED:
1. Student's handbook of Written English and Phonetics by DrPapori Rani Barooah (Eastern Book HousePublishers)
2. Strengthening your writing -V.R. Nayaranswami (OrientLongman)

PaperCode:DCSE202   **Credit:4**
Paper Name: Computer FundamentalsandProgramming   **L-T-P: 2-0-0**
Total ContactHours:35

Module 1:Computer Fundamentals   Contacthours:10
1.1 Brief history
1.2 Block diagram and differentcomponents
1.3 Memory & it's differenttypes
1.4 I/Odevices
1.5 Introduction to Operating System, Types and Role ofOS
1.6 Computer languages, translator software,editor.
1.7 Data, different types of data, information and itscharacteristics
1.8 Introduction to computer network and theInternet

Module 2: Number Systemandcodes   Contact hours:10
2.1 Different number systems - decimal, binary, octal, hexadecimal numbersystem
2.2 Number Conversions
2.3 1's and 2's Complement, subtraction usingcomplements.
2.4 Different codes- ASCII, BCD, Ex-3, Gray
2.5 Conversion from Gray to binary and vice-versa
2.6 BCDAddition.

Module 3: Introduction toCprogramming   Contact hours:15
3.1 Fundamentals of programming-Algorithm &Flowchart
3.2 Source code and objectcode
3.3 Basic structure of Cprograms
3.4 Executing a Cprogram
3.5 C Tokens, Keywords and Identifier, Constants, Variables, Storage Class and Datatypes.
3.6 Operators andexpression
3.7 Input Output function like printf, scanf, getchar, putchar, gets,puts
3.8 Decision making and branching using IF..Else,Switch
3.9 Looping using for, while, anddo-while
3.10 Array

Books / References:
1. Computer Fundamentals Paperback by Priti Sinha Pradeep K.Sinha(Author), BPBPublication
2. Byron Gottfried, "Programming with C", Tata McGrawHill.
3. Herbert Schildt, "The complete Reference C",TMH
4. Balagurusamy, E. (2019). *Programming in ANSI C, 8/e*. McGraw-HillEducation.
5. YashwantKanetkar, "Let us C", BPBPublication
6. Henrry Mulish, Herbert L. Cooper, "The Spirit of C: An Introduction to Modern Programming", Jaico Books.
7. Briain W. Kenigham and Dennis Ritchie, "C Programming language", Prentice Hall ofIndia.

PaperCode:DCSE272   **Credit:2**

Paper Name: Computer Fundamentals and Programming LabL-T-P: 0-0-2
Total contact hours: 32

Module 1: Basic Commands forComputerSystem   **Contacthours:2**

Module 2: PreparationofDocuments   **Contacthours:6**
2.1 Introduction to Word processing: Opening a document, preparing documents, inserting diagrams and tables
2.2 Editing document- (a) Character, word and line editing, (b) Margin Setting, Paragraph alignment, (c) Block Operations, (d) Spell Checker, (e) Saving a document, (f)Mailmerge.

Module 3: Information PresentationthroughSpreadSheet   **Contact hours:8**
3.1 Application ofSpreadSheet
3.2 Structure ofspreadsheets
3.3 Preparing table for simple data and numericoperations
3.4 Using formulae and functions in excel operations, Creation of graphs, Pie charts, barcharts.

Module 4: Preparationofpresentation   **Contact hours:6**
4.1 Creation of electronic slides on anytopic
4.2 Practice of animationeffect
4.3 Presentation ofslides

Module 5: Programmingin C   **Contact hours:10**
5.1 Editing a Cprogram
5.2 Defining variables and assigning values tovariables
5.3 Arithmetic and relational operators, arithmetic expressions and theirevaluation
5.4 Practice on input/output functions like getchar, putchar, gets, puts, scanf, printfetc.
5.5 Programming exercise on simple if statement, If..else statement, switchstatement
5.6 Programming exercise on looping with do-while, while, for loop andarray.

Books / References:
1. Foundations of Information Technology Coursebook 9: Windows 7 and MS Office 2007 (With MS Office 2010 Updates)-*SangeetaPanchal,AlkaSabharwal*
2. Microsoft Office 2016 Step by Step by Joan Lambert and CurtisFrye
3. Herbert Schildt, "The complete Reference C",TMH
4. YashwantKanetkar, "Let us C", BPBPublication
5. Balagurusamy, E. (2019). *Programming in ANSI C, 8/e*. McGraw-HillEducation.
6. Henrry Mulish, Herbert L. Cooper, "The Spirit of C: An Introduction to Modern Programming", JaicoBooks.
7. Briain W. Kenigham and Dennis Ritchie, "C Programming language", Prentice Hall ofIndia.

Semester III

Course Name: Mathematics-III
CourseCode:DMA301   **Credit:06**
Totalcontacthours:40   **L-T-P:3-0-0**

Module1:Matrices   **(8 Hours)**

First Order ODE:

- Formation of differential equations.
- Separable equations.
- Equations reducible to separable form.
- Exactequations.
- Integratingfactors
- Linear first order equations; Bernoulliequation.
- OrthogonalTrajectories.

Module 2: Ordinary differentialequations(ODE)   **(20 Hours)**

First Order ODE:
- Formation of differentialequations.
- Separable equations.
- Equations reducible to separableform.
- Exactequations.
- Integratingfactors
- Linear first order equations; Bernoulliequation.
- OrthogonalTrajectories.

Second Order ODE:
- Homogenous linear equations of arbitrary order with constantcoefficients.
- Non homogenous linear equations with constant coefficients.
- Euler's and Cauchy'sequations.
- Method of variation ofparameters.
- System of linear differentialequations.

Module 3:VectorCalculus   **(12 Hours)**

- Introduction to vectorCalculus.
- Scalar field and victorfield.
- Derivative and integration of vectorfunctions.
- Partial derivative ofvectors.
- Directionalderivatives.
- Tangent plane and normal to a levelsurface.
- Gradient, divergence and curl.

Books / References:

Sl.	Author, Publisher & Address	Edition, Year of	Title

No.		Publication	
1.	S.S. Sastry, Prestice Hall of India, New Delhi	Ed. 1994	Engineering Mathematics Vol-I
2.	Thomas &Finnery, Narosa Publishing Co. New Delhi	Ed. 1999	Calculus and Analytical Geometry
4.	B.S. Grewal, Krishna Publishers, New Delhi	Ed. 1999	Higher Engineering Mathematics
5	Murray R. Spiegel and Seymour Lipschutz, Mcgraw Hill, (Schaum's Outlines Series)	2nd edition 2009	Vector Analysis
6	BhuDev Sharma, KedarNath Ram Nath	Latest	Differential Equations
7	Dr. M. D. Raisinghania, S. Chand	19th Edition	Ordinary and partial Differential Equations
8	Shepley L. Ross, Wiley	Third Edition (Wiley Student Edition)	Differential Equations

Course Title: Engineering Economics and Accountancy
CourseCode:DHSS302   **Credit:08**
Totalcontacthours:52   **L-T-P:3-1-0**

Part-A Engineering Economics	
Module 1: Introduction to Economics 1.1 Definition of Economics, Its utility and scope of theStudy. 1.2 Definition of EngineeringEconomics 1.3 Meaning and concepts of Utility, Consumption, value, price, Goods and National income,Inflation. 1.4 Wants, Definition andCharacteristics 1.5 Wealth and Welfare – Definition, meaning andtypes.	**4 Hours**
Module 2: Demand and Supply 2.1 Meaning and types ofDemand 2.2 The law of Demand, itslimitations 2.3 Preparation of Demand Schedule 2.4 Meaning ofSupply 2.5 The law of supply, itslimitations 2.6 Preparation of supply schedule	**6 Hours**
Module 3: Production 3.1 Meaning and factors ofProduction 3.2 Factors determining efficiency oflabour 3.3 Saving, investment and capitalformation 3.4 Meaning of ProductionFunction	**4 Hours**
Module 4: Money 4.1 Meaning ofMoney 4.2 Types ofMoney 4.3 Functions ofMoney	**3 Hours**
Module 5: Banking Organisation 5.1 Central Bank – its functions 5.2 Commercial Banks – its functions	**3 Hours**
Module 6: Pricing	**4 Hours**

6.1 Objective of Pricing Policy 6.2 Pricedeterminants 6.3 Pricediscrimination	

Part-BAccountancy	
Module 7: Introduction to Book Keeping and Accountancy 7.1 Definition and objectives of BookKeeping 7.2 Need and Advantages of BookKeeping 7.3 Definition ofAccounting 7.4 Difference between book keeping andaccounting 7.5 Double Entry Systems – mainfeatures 7.6 Advantage and dis advantages of Double EntrySystem	**5 Hours**
Module 8: Introduction to Computerised Accounting System 8.1 Components of Computerised AccountingSoftware 8.2 Need for ComputerisedAccounting 8.3 Difference between computerised Accounting and Manual Accounting	**3 Hours**
Module 9: Transaction 9.1 Definition 9.2 Meaning ofAccount 9.3 Classification of Accounts: Traditional Approach and ModernApproach 9.4 Meaning of Debit andCredit 9.5 Rules of Debit andCredit	**3 Hours**
Module 10: Journal and Ledger 10.1 Meaning ofJournal 10.2 Recording of Transaction inJournal 10.3 Meaning ofLedger 10.4 Objective and Utility ofLedger 10.5 Posting and Balancing ofLedger 10.6 Distinction between Journal andLedger 10.7 Names of Different Books of Accounts	**5 Hours**
Module 11: Cash Book 11.1 Meaning and Importance of CashBook 11.2 Characteristics and Advantages of CashBook 11.3 Discount – Trade Discount and CashDiscount 11.4 Different Types of Cash Book: Single column cash book, Double column Cash Book and Triple column Cashbook 11.5 Bank Reconciliation Statement – BasicIdea	**5 Hours**
Module 12: Trial Balance and Error in Accounting 12.1 Meaning and Objects of TrialBalance 12.2 Main features and Advantage of TrialBalance 12.3 Preparation of Trial Balance 12.4 Types of Error inAccounting	**3 Hours**
Module 13: Components of Final Accounts 13.1 Meaning and objectives of TradingAccount 13.2 Contents of TradingAccount 13.3 Meaning and objectives of Profit and LossAccount 13.4 Contents of Profit and LossAccount 13.5 Meaning of Depreciation, revenue expenditure and capitalexpenditure 13.6 Contents of Balance Sheet	**4 Hours**

Books / References:
1. Introductory Micro Economics- Sandeep Garg- DhanpatRai Publication Pvt. Ltd. New Delhi.
2. Introductory Macro Economics- Sandeep Garg- DhanpatRai Publication Pvt. Ltd. New Delhi.
3. Theory and Practice of Accountancy-B.B. Dam, R.A. Sarda, R. Barman, B. Kalita-Capital Publishing Company,Guwahati-5.
4. Book-Keeping & Accountancy- Juneja. Chawla &Saksena- Kalyani Publisher, New Delhi-110002.
5. Tally. ERP 9 for Beginners- Tally Solutions Pvt. Ltd- Sahaj Enterprises,Bangalore.

Course Title: Electrical Circuits and Networks

CourseCode:DIE301   **Credit:06**
Total contacthours:35   **L-T-P:2-1-0**

Module 1:D.C. Circuits   **(8 Hours)**

Series Circuit, Parallel Circuit, Features, Advantages and Applications of Series and Parallel Circuits, Series-Parallel Circuits and Their Applications, Duality Between Series and Parallel Circuits, Internal Resistance of A Supply, Equivalent Resistance, Open Circuits and Short Circuits, Wheatstone Bridge, Kirchoff's Laws-KCL and KVL, Sign Convention, Illustration of Kirchoff's Laws, Matrix Algebra, Cramer's Rule, Voltage and Current Sources, Ideal Voltage Source or Constant Voltage Source, Real Voltage Source, Ideal Current Source, Real Current Source, Source Conversion, Ground, Voltage Divider Circuit, Current Divider Circuit.

Module 2: D.C.NetworkTheorems   **(8 Hours)**

Network Terminology – Linear Circuit, Non-Linear Circuit, Bilateral Circuit, Unilateral Circuit, Active Element, Passive Element, Node, Junction, Branch, Loop, Mesh, Active and Passive Networks. Network Theorems and Techniques- Maxwell's Mesh Current Method, Nodal Analysis, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Millman's Theorem, Compensation Theorem, Delta-Start and Star-Delta Transformation, Tellegen's Theorem.

Module 3:D.C. Transients   **(4 Hours)**

RL Circuit- Growth of Current, Decay of Current. RC Circuit- Charging A Capacitor, Discharging A Capacitor. Transient Response of RLC Circuits.

Module 4: Single PhaseA.C.Circuits   **(8 Hours)**

Basics of Sinusoids, Advantages of Sinusoidal Waveform, Terminologies For Alternating Quantities-Waveform and Waveshape, Period and Frequency, Phase, Phase Difference and Phase Shift. Values of Alternating Quantities - Instantaneous Value, Peak/Maximum/Crest Value, Average/Mean Value, Effective/Rms Value, Phasor Representation, Complex Number System, Phasor Representation, Phasor Diagram. Pure Resistive Circuit, Pure Inductive Circuit, Pure Capacitive Circuit, Series RL Circuit, Series RC Circuit, Series RLC Circuit, Parallel RL Circuit, Parallel RC Circuit, Parallel RLC Circuit, Power Relations in A.C. Circuits, Reactive Power, Power Triangle, Complex Power.

Module5:Resonance   **(7 Hours)**

Series Resonance - Quality Factor(Q), Sharpness of Resonance, Fractional Detuning Factor (δ), Expression of Z In Terms of Fractional Detuning Factor (δ) and Quality Factor(Q), Expression For Half Power Frequencies in RLC Series Resonant Circuits, Selectivity. Parallel Resonance - Relationship Among Z, Q and δ, Resonance Between Parallel RL and RC Circuits, Parallel RLC Circuits.

Books / References:

1) Network Theory: Analysis And Synthesis By Smarajit Ghosh, Phi Learning PrivateLimited.

2) Network Analysis and Synthesis By S P Ghosh and A K Chakraborty, Tata McGraw-HillEducation.

3) Basic Electrical Engineering By V. K. Mehta, Rohit Mehta, S Chand & CompanyLimited.

4) Network Theory ByVenkatesh K. Channa, Pearson EducationIndia.

Course Title: Electrical Circuits and Networks Lab
CourseCode:DIE371   **Credit:02**
Totalcontacthours:2/week   **L-T-P:0-0-2**

List of experiments to be performed by the students for Electrical Circuits and Networks Lab

1. To study ohm's law and plot its VI characteristics in both ac and dcanalysis.

2. To verify dc/ac of parallelcircuits.

3. To verify dc/ac of series circuits.

4. To study voltage divider circuit usingpotentiometer.

5. To study Thevenin'sTheorem

6. To study Norton'sTheorem

7. To study Superposition Theorem

8. To study ReciprocityTheorem

9. To study maximum power transfertheorem

10. To study transient response of a RCcircuit.

Course Title: Electronics Devices and Circuits-I
CourseCode:DIE302   **Credit:06**
Total contacthours:35   **L-T-P:2-1-0**

Module1:Diodes   **(8 Hours)**

The ideal diode, terminal characteristics of junction diodes, diode forward characteristics, operation in the reverse breakdown region-zener diodes, rectifier circuits, limiting and clamping circuits, special purpose diodes.

Module 2: BipolarJunctionTransistor   **(8 Hours)**

Device structure and physical operation, I-V Characteristics, BJT as a switch and an amplifier, Biasing in BJT amplifier circuits, BJT AC Analysis, Single Stage BJT Amplifiers

Module 3: FieldEffect Transistor   **(7 Hours)**

Introduction, Construction, basic principle of Operation and Characteristics of JFETs, Depletion- Type MOSFET and Enhancement –Type MOSFET, FET as a switch and an amplifier, FET biasing , FET amplifier.

Module 4:PowerAmplifier   **(7 Hours)**

Introduction, Series-Fed and transformer-coupled Class A Amplifier, circuits and operations of Class B and Class C Amplifiers

Module 5:PowerSupplies   **(5 Hours)**

Introduction, Capacitor Filter, RC Filter, Discrete Transistor Voltage Regulation, IC Voltage Regulations,Regulated Power Supply Design, Adjustable Power Supply

Books / References:

1. Electronics Devices and Circuits by J.B. Gupta,S.K. Kataria and Sonspublication.

2. Electronics Devices and Circuit Theory by Robert L. Boylestad and LouisNashelsky, Pearsonpublication
3. Microelectronic Circuits, Theory and Applications by Adel S. Sedra and Kenneth C. Smith, Oxfordpublications
4. Electronic Devices and Circuits by JacobMillman,Mcgrawhill

Course Title: Electronics Devices and Circuits-I Lab
CourseCode:DIE372   **Credit:02**
Total contacthours:2/week   **L-T-P:0-0-2**

List of experiments to be performed by the students for Electronics Devices and Circuits-I Lab

1. To study the forward and reverse biased V-I characteristics of a (general purpose/Zener)diode.

2. To study the input and output signal waveform of a diode based positive/ negative clippercircuit.

3. To study the input and output signal waveform of a diode based positive/ negative clampercircuit.

4. To study the waveform of a centre tap full-wave rectifier with shunt capacitancefilter.

5. To study the waveform of a bridge full-wave rectifier with shunt capacitancefilter.

6. To design and study of a common emitter fixed biasing transistoramplifier.

7. To design and study of a common emitter voltage divider biasing transistoramplifier.

8.To study a LM-317 voltage regulator based variable powersupply.

9.To design and study the LM-317 voltage regulator based constant powersupply.

10. To study the LM-78XX/-79XX voltage regulator based constant power supply.

11. To study the transistor based push-pull poweramplifier.

Course Title: Fundamentals of Instrumentation
CourseCode:DIE303   **Credit:06**
Totalcontacthours:35   **L-T-P:2-1-0**

Module1:Introduction   **(7 Hours)**

Scope and necessity of Instrumentation, typical application of instrument system, functional elements of instrumentation system, classification of instruments, name of important process variables and measurement methods, introduction to transducer and signal conditioning, standards and calibration.

Module 2: Static Performance CharacteristicsofInstruments.   **(5 Hours)**

Static performance parameters, impedance and loading effects.

Module 3: Errors in measurements andtheirstatisticalanalysis   **(7 Hours)**

Limiting error, relative limiting error, combination of quantities with limiting errors, types of errors: gross, systematic and random errors.

Statistical treatment of data, arithmetic mean, measure of dispersion from the mean, deviation, standard deviation, variance, probability of errors, error estimates from normal distribution

Module 4: Dynamic CharacteristicsofInstruments.   **(6 Hours)**

Introduction, formulation of system equation, transfer function, standard inputs to study dynamic response of instruments, zero order instruments, first order instruments, second orderinstruments.

Module 5: DataPresentationElements   **(3 Hours)**

Strip chart and X-Y recorders, segmental displays, dot matrices, LED and LCD Display

Module6:Applications   **(7Hours)**

Brief study of instruments used for measurement of temperature, pressure, flow rate, level, displacement and humidity.

Books / References:
1. Instrumentation Measurement and Analysis by B.C. Nakra and K.K. Choudhry, McGraw Hill Publications.
2. Instrumentation for Process Measurement and Control by Norman A. Anderson, CRC Press
3. Electrical and Electronic Measurements and Instrumentation by A.K. Sawhney, DhanparRai& Co.Publication
4. Introduction to Measurements and Instrumentation by Arun K. Ghosh, PHIPublication

Course Title: Digital Electronics
CourseCode:DIE304   **Credit:06**

Total contact hours:35Hours   **L-T-P:2-1-0**

Module1:NumberSystems: **(6 Hours)**

Introduction to Digital systems, Introduction to number systems (Binary, Decimal, Octal, Hexadecimal), Number representation in binary (Signed, One's and Two's complement), Binary Codes (BCD, Excess-3, Gray, Alphanumeric, Seven segment display code and Error detection and correction codes), Digital Arithmetic (Binary, BCD, Excess-3 arithmetic).

Module 2.Logicgates: **(3 Hours)**

Introduction to various logic systems (positive & negative), Truth Table, Logic gates (OR, AND, NOT, BUFFER, EX-OR, EX-NOR), Universal gates (NAND, NOR), Tristate logic gates.

Module3.Logicfamilies: **(4 Hours)**

Significance and types of logic families (RTL, DTL, TTL), Characteristic parameters (Fan-out, Fan-in, Noise margin, Propagation Delayetc…).

Module 4.Boolean Algebra andSimplificationTechniques: **(4 Hours)**

Introduction to Boolean algebra and its postulates and theorems, SOP and POS Boolean expressions, Simplification techniques (using Boolean theorems, K-Map).

Module5.CombinationalCircuits: **(7 Hours)**

Arithmetic circuits (Adder, Subtractor, parallel binary adder, BCD adder, carry-propagation-look-ahead-carry generator, magnitude comparator), Multiplexer, De-multiplexer, Encoder, Decoder, Parity generator-checker.

Module 6.SequentialCircuits: **(8 Hours)**

Concept of multivibrator, Flip-flops (R-S flip-flop, J-K flip-flop, D flip-flop, T flip-flop), flip-flop with preset and clear inputs, level and edge triggered flip-flops, race-around condition in flip-flops, Counters and Registers (asynchronous and synchronous counters, UP/DOWN counters, Ring counter).

Module 7.ProgrammableDevices: **(3 Hours)**

PROM, PLA,PAL.

Books/References:
1. Morris Mano, Prentice Hall of India, New Delhi: Digital Logic and ComputerDesign
2. Malvino, Tata McGraw Hill New Delhi: Digital ComputerElectronics
3. A. Anand Kumar, PHI Learning Private Limited, Delhi: Fundamentals of DigitalCircuits
4. Anil K. Maini, Wiley: DigitalElectronics

Course Title: Digital Electronics Lab
CourseCode:DIE374   **Credit:02**
Total contacthours:2/week   **L-T-P:0-0-2**

List of experiments to be performed by the students for Digital Electronics Lab

1. Input-output verification of logic gates (ICs74xx-group).

2. Practical validation of De-Morgan's theorem.

3. Practical validation of Boolean expressions and its minimizedexpression.

4. Implementation of various gates/Boolean expression by using universal gatesonly.

5. Design and study of half-adder and full-addercircuits.

6. Design and study of half-subtractor and full-subtractor circuits.

7. Design and study of digital multiplexer (4:1 / 8:1)circuit.

8. Design and study of digital de-multiplexer (1:4 / 1:8)circuit.

9. Design and study of Encodercircuit.

10. Design and study of Decoder circuit.

11 Study of Flip-flop circuits (R-S and J-K).

Course Name: Electrical Machines
Course Code: DEE401   **Credit: 06**
Total contact hours: 35   **L-T-P: 2-1-0**

Module1: DC MACHINES   **(10 hours)**
Introduction to DC machines, study and drawing of various parts of a DC machine, DC generators, EMF equation, lap and wave winding (very briefly), shunt, series and compound generators, losses and efficiency studies, armature reaction (introduction only)
Principle of DC motor, electromagnetic torque, Back EMF, shunt, series and compound motors, losses and efficiency studies, motor characteristics studies, speed control of DC motors, DC motor starters, Industrial applications of DC machines, Electric braking, Permanent magnet DC motors, etc.
Module2: TRANSFORMERS   **(8 hours)**
Introduction, construction and working principles, Ideal transformer, EMF equation, voltage transformation ratio, practical transformer on no-load and on–load, equivalent circuits, shifting impedances, transformer's tests, voltage regulation, losses and efficiency studies, autotransformer, applications of transformers.
Module3: INDUCTION MOTOR   **(7 hours)**
Introduction, construction, types and working principle, slip, torque under starting and running conditions, torque-slip curve, losses and efficiency studies, starting methods, speed control, industrial applications in different areas.
Module4:SPECIAL MACHINES   **(10 hours)**
Single-phase induction motor, Hysteresis motor, reluctance motor, two-phase servo motor, DC tachometers, stepper motor,

Reference books --
1. A Text Book of Electrical Technology (Vol. 2) by B.L. Theraja and A.K. Theraja
2. Principles of electrical machines by V.K. Mehta and R.K. Mehta
3. Electrical Machinery by Dr. P.S. Bimbhra

Course Name: Electrical Machines Lab
Course Code: DEE471   **Credit: 02**
Total contact hours: 2/week   **L-T-P: 0-0-2**

List of experiments to be performed by the students for Electrical Machines Lab

1. Open circuit characteristics of a DC shunt generator
2. Speed control of DC shunt motor
3. Ratio and polarity test on single-phase transformer
4. Open and short circuit test on single-phase transformer
5. Load test of single-phase induction motor
6. Study of various parts of three phase induction motor
7. Connecting a three phase IM with three phase supply through 3-phase autotransformer
8. Reversing the direction of rotation of a 3-phase induction motor
9. Study of various parts of single phase induction motor (ceiling fan and water pump motors)

Course Title: Electronics Devices and Circuits-II
Course Code: DIE401   Credit: 06
Total contact hours: 35   L-T-P: 2-1-0

Module 1: Feedback Amplifiers   **(8 Hours)**
Principle of feedback amplifier, Classification of feedback amplifiers, advantage of negative feedback- gain stability, decreased distortion, increased bandwidth,Principles of operation of four types of feedback amplifiers (voltage series/shunt, current series/ shunt).

Module 2: Oscillators   **(7 Hours)**
Basic theory of oscillator, Classification of oscillators, Operation of Colpitt's and Hartley Oscillators, RC phase shift oscillators, wien bridge oscillator, Crystal oscillator.

Module 3: Tuned Amplifiers   **(6 Hours)**
Introduction, Classification of Tuned Amplifiers,Single turned amplifiers, FET tuned amplifiers, Double tuned amplifier, large signal tuned amplifiers, Effect of Oscillations in tuned amplifier, Stagger tuned amplifiers

Module 4: Operational Amplifiers   **(8 Hours)**
Introduction, Op-amp Symbol and terminals, Ideal op-amp, block diagram of op-amp, ideal op-amp characteristics, op-amp parameters, open loop configuration of op-amp. closed loop configuration of op-amp, op-amp IC 741,Realistic simplifying assumptions, op-amp applications- inverting amplifier, non-inverting amplifier, voltage follower, Summing amplifier, Difference amplifier, Integrator, Differentiator

Module 5: Multivibrators   **(6 Hours)**
Introduction, multivibrators, astablemultivibrator, monostablemultivibrator, bistablemultivibrator, comparison between different multivibrators.

Books / References:

1. Electronics Devices and Circuits by J.B. Gupta,S.K. Kataria and Sons publication.
2. Electronics Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky,
   Pearson publication
3. Microelectronic Circuits, Theory and Applications by Adel S. Sedra and Kenneth C.
   Smith, Oxford publications
4. Electronic Devices and Circuits by Jacob Millman, Mcgrawhill

Course Title: Electronics Devices and Circuits-II Lab
Course Code: DIE471   Credit: 02
Total contact hours: 2/week   L-T-P: 0-0-2

List of experiments to be performed by the students for Electronics Devices and Circuits-II Lab

1. To study a transistor based differential amplifier.

2. To design a transistor based AstableMultivibrator and study its various waveform parameters.

3. To study the operation of Hartley/Colpitt's oscillator.

4. To design and study an Inverting and a Non-inverting OP-AMP based voltage Amplifier with some specific gain.

5. To study OP-AMP based summer and subtractor circuit.

6. To study an OP-AMP based Differentiator and Integrator circuit.

7. To design an OP-AMP based Differential amplifier and study its voltage Amplification factor.

8. To design an OP-AMP based Schmitt trigger and study its various waveform parameters.

9. To design an OP-AMP based Inverting/Non-inverting amplifier and study its frequency response of the amplifier.

10. To design a LM-555 based AstableMultivibrator and study its various waveform parameters.

Course Title: Transducer and Signal Conditioning
Course Code: DIE402   **Credit: 06**
Total contact hours: 35   **L-T-P: 2-1-0**

Module 1: Introduction   **(4 Hours)**
   Basic concepts Definition and classification of transducers
Module 2:Resistive Transducers   **(6 Hours)**
   Construction, working principle, selection criteria, advantages, disadvantages and application of Potentiometer, strain gauge, load cell, hot wire anemometer, photo resistors, RTD, Thermistors and resistive accelerometer. Signal conditioning circuits for resistive transducers
Module 3: Variable Inductance Transducers   **(6 Hours)**
   Construction, working principle, selection criteria, advantages, disadvantages and application of Electromagnetic pick up, Linear variable differential transformer, Synchronous transmitter and receivers. Signal conditioning circuits for variable inductance transducer.
Module 4: Variable capacitance Transducers   **(6 Hours)**
   Construction, basis principle, selection criteria, advantages, disadvantages and application of capacitive transducer, differential capacitive transducer, capacitive microphone. Signal conditioning circuits for variable capacitance transducer.
Module 5: Piezoelectric, Optical and Ultrasonic Transducer   **(7 Hours)**
   Construction, basic principle, selection criteria, advantages, disadvantages and application of Piezoelectric Transducer, Seismic pick up, Optical Transducer: photoconductive, photovoltaic, photodiode, photo transistor and Ultrasonic Transducer. Signal conditioning circuits for Piezoelectric, Optical and Ultrasonic Transducer.
Module 6: Other types of transducers   **(6 Hours)**
   Construction, basic principle, selection criteria, advantages, disadvantages and application of Hall Effect, Digital transducer-single shaft encoder and Techo generator.

Books / References:

1. Curtis D Johnson, Process Control and Instrumentation, PHI,7TH edition,2005
2. D Patranabis, Sensors and Transducers, PHI, 2nd ed., 2003.
3. D.V.S. Murty, Transducers and Instrumentation, PHI, 1995.
4. A K Sawhney: A course on electrical and electronic measurements and instrumentation, DhanpatRai& Co, 2005

Course Title: Transducer and Signal Conditioning Lab
Course Code: DIE472   **Credit: 02**
Total contact hours: 2/week   **L-T-P: 0-0-2**

List of experiments to be performed by the students for Transducer and Signal Conditioning Lab

1. To study LDR and plot the graph of its I-V characteristics response.

2. To study photodiode and plot its I-V characteristics response.

3. To study phototransistor and plot its I-V characteristics response.

4. To study strain gauge and plot its corresponding response between weight versus strain. Also find its sensitivity.

5. To study LVDT and plot its corresponding response between displacement versus output voltage. Also find its sensitivity.

6. To study RTD and its signal conditioning circuit using Wheatstone bridge. Also, plot the response curve between temperature and output voltage.

Course Title: Microprocessor
Course Code: DIE403   **Credit: 06**
Total contact hours: 40 Hours   **L-T-P: 2-1-0**

Module1: Microprocessors Based Systems   **(4 hours)**

Microprocessors, microcomputers and assembly language, introduction to 8085 assembly language programming.

Module2: Introduction to 8085 Assembly Language Programming(6 hours)

The 8085 programming model, instruction classification, instruction, data format and storage, overview of the 8085 instruction set.

Module3: Architecture of 8-bit Microprocessor   **(5 hours)**

Intel 8085Amicroprocessor, Pin description and internal architecture, memory interfacing, interfacing input & output devices.

Module4: Operation and Control of Microprocessor   **(6 hours)**

Timing and control unit, opcode fetch machine cycle, memoryread/write machine cycles, I/O read/write machine cycles, interrupt acknowledge machine cycle, statetransition diagram.

Module5: Programming the 8085   (8 hours)

Introduction to 8085 programming, programming techniques, counters and time delays, stack and subroutines.

Module6: Code Conversion, BCD Arithmetic, 16- bit Data Operations(5 hours)

BCD to Binary code conversion, Binary to BCD to seven-segment LED code conversion, BCD Addition and Subtraction introduction to advanced instruction and Application, Multiplication and subtraction with carry

Module7: Basic Interfacing Concept(6 hours)

Interfacing input Keyboard, Memory-mapped I/O, 8085 interrupt, D-A and A-D Convertor, 8255A programmable peripheral Interface, 8253 Programmable interval Timer, Basic concept of Serials I/O, software controlled Asynchronous serial I/O, SID, SOD, Hardware – controller serial I/O using Programmable chips.

Textbooks/References:
1. Microprocessors Architecture, programming and Applications With 8085/8080A - R.S. Gaonkar, Wiley Eastern

Limited, New Delhi
2. Introduction to Microprocessors - Mathur, Tata McGraw Hill, New Delhi
3. Microprocessors Technology and Microcomputers - Pashow, Mc-Graw Hill. Inc., New York.

Course Title: Microprocessor Lab
Course Code: DIE473   **Credit: 02**
Total contact hours: 2/week   **L-T-P: 0-0-2**

List of experiments to be performed by the students for <u>Microprocessor Lab</u>

1. Write an assembly program to add two 8 bit numbers using 8085 µp LCD kit.
2. Write an assembly program to subtract two 8 bit numbers using 8085 µp LCD kit.
3. Write an assembly program to multiply two 8 bit numbers and execute it with the help of 8085 µp LCD kit.
4. Write an assembly program to divide two 8 bit numbers and execute it with the help of 8085 µp LCD kit.
5. Perform to add two 16 bit numbers using DAD instruction and execute it with the help of 8085 µp LCD kit.
6. Write an assembly program to transfer of ten data from C330H-C339H to C770H-C779H and execute it with the help of 8085 µp respectively.
7. Write an assembly program to find out the smaller of two numbers using 8085 µp LCD kit.

8. Write an assembly program to find out the larger of two numbers using 8085 µp LCD kit.
9. Write an assembly program to find out one's complement and two's complement of 8 bit numbers using 8085 µp LCD kit.

10. Write an assembly program to find out how many numbers are even numbers. From the data array and execute it with the help of 8085 µp LCD kit.

Course Title: Control Systems
Course Code: DIE404   **Credit: 06**
Total contact hours: 35   **L-T-P: 2-1-0**

Module1: BASICS OF CONTROL SYSTEMS, LAPLACE TRANSFORM, SYSTEM COMPONENTS
                                                                   (8Hours)
   a. Introduction to the history and development of the Systems approach concept and history of the Control systems concept Examples from Industrial application and human systems.

   b. Definition of other types of classification of Control Systems:- (i) linear and Nonlinear Systems (ii) Single Input – Single Output System (SISO) and Multi Input (MIMO) system (iii) Continuous and Discrete System (iv) Analog and Digital Systems.

   c. Open loop control system and Close loop control system, terminology, Feedback control systems, Advantages and Disadvantages.
   d. Overview of Electrical systems and Thermal systems.

   e. Introduction to Laplace Transforms and Inverse Laplace Transform, and its application.

Module2:PHYSICAL REALISATION OF MECHANICAL SYSTEMS, TRANSFER FUNCTION

a. Comparison and Analysis of Mechanical, Translational and rotational motions, Equivalence representation using R, L, C networks. Introduction to Modelling of simple First order Industrial Processes i.e. Heat Exchange, Level in a single and multiple interconnected tanks.
b. Control System representation: Transfer function, Type and Order of systems, characteristic equation and its properties.
c. Examples

Module3:BLOCK DIAGRAM REPRESENTATION AND SIGNAL FLOW DIAGRAM TECHNIQUES
(5Hours)

a. Block Diagram, Reduction techniques
b. Definition and introduction to Signal Flow Diagram, Masons Gain Formula.
c. Examples

Module4:TIME RESPONSE ANALYSIS: (8 Hours)

a. Time Response Analysis: Standard Test Signals – Step, Ramp, Pulse, Sinusoidal types of inputs, Concept of Type and Order of a transfer function. Poles and Zeroes of Open Loop and Closed Loop transfer functions. Time Response of first and second order systems, Time constant concept, Transient and Steady State Response, Second order response specification (Over shoot, Damping Ratio, Rise time, Peak time Settling time)and its applications to systems(No derivation of Second order systems) Examples of Steam Jacketed heating system,
b. Initial and Final value Theorem Steady State errors and Error constants.
c. Examples.

Module5:STABILITY ANALYSIS IN TIME AND FREQUENCY DOMAIN (7Hours)

a. Concept of Stability and its Analysis using Routh Horowitz stability criteria,
b. Root Locus Method of analysis. Angle and Magnitude criteria,
c. Introduction to frequency response methods of analysis: Polar Plot, Bode Plot, Phase and Gain Margin.
d. Examples

Textbooks/References:

1. Linear Control Systems by B S Manke, Khanna Publishers.
2. Control Systems by A. Anandkumar , EEE, PHI
3. Advanced Control theory by I.J. Nagrath and M. Gopal, New Age International publishers.
4. Video lectures from IIT Kharagpur, IIT Delhi NPTEL

Course Title: Control Systems Lab
Course Code: DIE474   **Credit: 02**
Total contact hours: 2/week   **L-T-P: 0-0-2**

List of experiments to be performed by the students for Control Systems Lab using MATLAB Programming:

1. To define the given Transfer Function.
2. To find the Laplace and Inverse Laplace Transform.
3. To reduce the given block diagram and obtain the overall Transfer Function and verify results theoretically.

4. To obtain the Unit Step, Unit Ramp, Unit Impulse and Unit Parabolic response of a first order system.
5. To obtain the Unit Step, Unit Ramp, Unit Impulse and Unit Parabolic response of a second order system.
6. To find the step response of second order system for different values of ε.
7. The open-loop transfer function of a unity-feedback system will be given, determine K_p, K_v, K_a and e_{ss} for each case.
8. To obtain the Unit-step response for the given second order system. Also determine the rise time, peak time, peak overshoot and settling time. Also verify results theoretically.
9. To obtain the Root locus plot for the system having open loop transfer function.
10. To obtain the Bode plot for a control system for a given open loop transfer function.