IPS Academy, Institute of Engineering & Science

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First Year, Semester II Group A [CSE, CSE-DS, RL, EC, EX, FT]

S. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1	BSC 201	Differential Equations and Vector Calculus	3	1	0	4
2	BSC 202	Applied Chemistry	2	1	2	4
3	ESC 201	Basic Civil Engineering & Engineering Mechanics	2	1	2	4
4	ESC 202	Basic Mechanical Engineering & Manufacturing Practices	2	1	2	4
5	ESC 203	Electronics and Computer Workshop	0	0	2	1
6	HSMC 101	English	2	0	2	3
7	MC 2	Rural Outreach	0	0	4	0
					Total Credits	**20**

First Year, Semester II Group B [CSIT, CSE-IOT, CS-IML, AIML, CE, CM, ME]

S. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1	BSC 201	Differential Equations and Vector Calculus	3	1	0	4
2	BSC 102	Optics & Modern Physics	2	1	2	4
3	ESC 101	Engineering Graphics & Visualization	3	0	2	4
4	ESC 102	Basic Electrical & Electronics Engineering	2	1	2	4
5	ESC 103	Programming for Problem Solving	3	0	2	4
6	MC 2	Rural Outreach	0	0	4	0
					Total Credits	**20**

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BSC-201	**Differential Equations and Vector Calculus**	**3L:1T:0P (4 Hrs)**	**4 Credits**

Course Objectives: The objective of this course is to fulfill the needs of engineers to understand the applications of solution of ordinary and partial differential equations, vector calculus in order to acquire mathematical knowledge and solving a wide range of practical problems.

Module-1

Ordinary Differential Equation-I: Solution of ordinary differential equation of first order and first degree by Separation of variables, Linear differential equations, Bernoulli's equations, Homogeneous equations, Reducible to homogeneous equations, Exact differential equations. **(9 Hours)**

Module-2

Ordinary Differential Equation-II: Linear higher order differential equations with constant coefficients, Second order linear differential equation with variable coefficients: Method of one integral is known, Removal of first derivative, Changing of independent variable and Variation of parameter; Series solution method: Series solution for ordinary point of the equation, Series solution for regular point of the equation. **(10 Hours)**

Module-3

Partial Differential Equation: Linear and non linear partial differential equation of first order: Formation of partial differential equations; Solution of linear partial differential equations of first order: Lagrange's linear equations; Solution of non–linear partial differential equations: First standard form, Second standard form, Third standard form, Fourth standard form, Charpit's Method. **(10 Hours)**

Module-4

Vector Differentiation: Vectors in 2-space and 3-space, Inner product (Dot product), Vector product (Cross product), Vector differentiation, Gradient of a scalar point function, Directional derivative, Divergence of a vector point function and Curl of a vector field. **(8 Hours)**

Module-5

Vector Integration: Vector integration, Line integral, Surface integral and Volume integral, Green's theorem, Gauss divergence theorem, Stoke's theorem. **(8 Hours)**

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

CO1: Recognize and solve the first order and first degree ordinary differential equations.
CO2: Identify and solve the second order linear differential equations with variable coefficients.
CO3: Understand and solve the linear and nonlinear partial differential equations.
CO4: Recognize and apply the concept of vector differentiation in engineering problems.
CO5: Identify and apply the concept of vector integration in different engineering problems.

Textbooks/References:

1. W. E. Boyce and R. C. Di Prima, Elementary Differential Equations and Boundary Value Problems, Wiley India, 9th edition., 2009.
2. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 2017.
3. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
4. R. K. Pandey, Vector Calculus, Oxford, 2012.
5. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2018.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43th Edition, 2015.
7. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson, 14th Edition, 2018.
8. N.P. Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, 2008.
9. T. Veerarajan, Engineering Mathematics for First Year, Tata McGraw-Hill, New Delhi, 2017.
10. C.R. Wiley, Advanced Engineering Mathematics, McGraw Hill Inc., New Delhi, 2007.

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BSC-202	Applied Chemistry	2L:1T:2P (5 Hrs)	4 Credits

Course Objective: The objective of this course is to introduce the students with the concepts of Engineering Chemistry and its applications.

Course Content:

Module 1: Water Analysis & its Treatment (12 Hrs.)

Sources, Impurities, Hardness & its units, Determination of hardness by EDTA method, Alkalinity & its determination and related numericals. Characteristics of municipal waste water its treatment.

Boiler Problem & Softening Methods: Boiler troubles :- Sludge & scale, Priming & foaming, Boiler corrosion, Caustic embrittlement, Internal treatment methods of softening :- Calgon conditioning, Colloidal conditioning, Carbonate conditioning, Phosphate conditioning , External treatment methods of softening :- Lime-Soda method, Zeolite method and Ion exchange method and related numericals.

Module 2: Lubricants (8 Hrs.)

Concept of tribology, Function of lubricants, Classification of lubricants, :- Liquid, solid and semisolid lubricants, Mechanism of lubrication, Properties of lubricating oils:- Viscosity & viscosity- index and numericals, Flash & fire Point, Cloud & pour Point, Anilline point, Acid number, Saponification number, Steam emulsification number.

Module 3: Fuel & Combustion (8 Hrs.)

Classification of fuel, Calorific value, Determination by Bomb Calorimeter, Dulong's Formula, Analysis of coal, Proximate and Ultimate analysis, Manufacture of metallurgical coke by Otto Hoffman's byproduct oven.

Module 4: Polymerization (6 Hrs.)

Introduction, Classification of polymers, Mechanism of polymerization (Free radical, Ionic polymerization & Copolymerization). Thermoplastic & Thermosetting polymers, Elementary idea of biodegradable polymers. Preparation, properties and uses :- Fiber – Polyamides (Nylons), Polyethylene Terephthalate (PET). Rubber/Elastomers – Vulcanization of rubber, Natural rubber, Cis-trans rubber, Synthetic rubber, Silicon rubber, Buna-S & Buna-N, Plastic - Phenolic resins, Urea formaldehyde resins, Silicon resins.

Module 5 : Nanotechnology & Corrosion and Spectroscopic Techniques (16 Hrs.)

Introduction of nanotechnology, growth of nano particles (Sol-gel process), Introduction of corrosion, Mechanism of dry & wet corrosion, Type of corrosion:- Galvanic corrosion, Pitting corrosion, Concentration cell corrosion, Water line corrosion, Stress corrosion, Prevention of corrosion.

An overview of various analytical techniques, Fundamentals of spectroscopy, Principle, Instrumentation and Applications of Ultraviolet –Visible spectroscopy, Infrared spectroscopy & Gas Chromatography.

Course Outcome: Students will be able to:

CO1: Understand the principles of hardness and identify suitable water and waste water treatment techniques.

CO2: To acquire knowledge about fundamentals of lubricants and their physiochemical properties.

CO3: Define and analyze the characteristics of coal and different combustion estimates.

CO4: To gain the knowledge of polymers, bio-degradable polymers and engineering applications of polymers.

CO5: Demonstrate and apply basic concepts of nanotechnology, corrosion and its prevention. To impart knowledge on the essential aspects of standard analytical techniques for Spectroscopy and Chromatography.

Suggested Reading

1. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing.
2. Engineering Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd.
3. Essentials of Physical Chemistry, Bahl & Tuli, S. Chand Publishing.
4. Applied Chemistry, Sunita Rattan, Kataria & Sons.
5. Engineering Chemistry, Baskar, Wiley India Research Gate.
6. Engineering Chemistry – I, D. Grour Krishana, Vikas Publishing.
7. Engineering Chemistry, Jain & Jain, Dhanpat Rai & Co.
8. Chemistry of the Elements:N. N. Greenwood and A. Earnshaw, Heinemann (later Elsevier).
9 Introduction to Nanotechnology: Charles P. Poole, Frank J. Owens, Wiley India Research Gate.
10. Instrumental Methods of Chemical analysis, Willard Dean, Merrittee, Tata Mac Graw Hill Ltd.
11. Laboratory Manual Engineering Chemistry, Anupma Rajput, Dhanpat Rai & Co.
12. Practical Journal of Engineering Chemistry, Dr. B. K. Mishra, Balaji learning Books.

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List of Experiments

1) Determine the chloride ion in a given water sample by Argentometric method.

2) To determine total hardness of given water sample by Complexometric titration method.

3) Determine the types of alkalinity in terms of $CaCO_3$ equivalents in given water sample.

4) To find out the viscosity index of given lubricating oil with change in temperature by Redwood viscometer No.1.

5) To find out the change of viscosity of given lubricating oil with change in temperature by Redwood viscometer No.2.

6) Determination of the flash & fire points of the given lubricating oil sample by Penskey Marten's Apparatus.

7) Determination of flash & fire points of the given lubricating oil sample by Abel's Apparatus.

8) Determination of flash & fire points of the given lubricating oil sample by Cleveland's Apparatus.

9) To determine the total dissolved solids in a given water sample.

10) Calculate the percentage moisture content in a given sample of coal.

Virtual Experiment

(11) Estimation of Metals through Electrogravimetric method.

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ESC – 201	**Basic Civil Engineering and Engineering Mechanics**	**2L:1T:2P (5Hrs)**	**4 Credits**

Course Objectives: Students will able to understand the basic properties of construction materials and key concept of surveying also with basic engineering mechanics concept.

Course Content:

Module 1 Introduction to construction materials & techniques (10 Hrs)

Classification, testing, properties and uses of stone, bricks, cement, sand, mortar, concrete, Brick masonry, stone masonry

Module 2 Basic Concepts of surveying (10 Hrs)

Introduction to basic survey-Plane table survey, chain survey and compass survey, Principle of chain survey, ranging, offsets, Principle of compass survey

Module 3 Introduction to Engineering Mechanics concepts (10 Hrs)

System of Forces, Components in Space – Resultant, Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Graphical and Analytical Treatment of concurrent and non-concurrent coplanar forces, force diagrams and Bow's notations, Lami's theorem, application to simple engineering structures and components

Module 4 Shear Force and Bending moment (10 Hrs)

Types of - support, Beams and loading, Support reaction, Concept and definition of shear force and Bending Moment. Bending moment and shear force diagram under various types of loading

Module 5 Centre of Gravity and moment of Inertia (10 Hrs)

Parallel axis and Perpendicular axis theorem,Centroid of plane figures and centre of gravity of masses and forces, moment of inertia of area and mass, radius of Gyration, principle axes of sections and principle of inertia.

Course Outcomes:

Students will be able to

CO1. Understand the basic construction materials and their properties.

CO2. Understand the basic concept of surveying.

CO3. Apply concepts of forces, their resolution and applications in engineering practice.

CO4. Analyze various types of beams under different loading condition also the concept of shear force and bending moment diagram.

CO5. Compute centroid, Centre of gravity and moment of inertia of various symmetrical sections.

Textbooks/References:

1. S. Ramamrutam & R.Narayanan, "Basic Civil Engineering", Dhanpat Rai Pub.(2013)
2. Prasad I.B., "Applied Mechanics", Khanna Publication,19th edition
3. Punmia, B.C., "Surveying", Standard book depot. (2003)
4. Shesha Prakash and Mogaveer; "Elements of Civil Engg & Engg. Mechanics", PHI ,3rd edition
5. S.P,Timoshenko , "Mechanics of stricture", East West press Pvt.Ltd.
6. Duggal, "Surveying", Tata McGraw Hill New Delhi. Vol 1,3rd edition(2013)
7. R.K. Rajput, "Engineering Mechanics", S.Chand & Co.(2013)
8. Verma, M. K., "Introduction to Mechanics", Universities Press.(2016)
9. Grucharan Singh, "Building construction", Standard Book House, New Delhi,17th edition(2018)

List of Experiment:

1. To determine the accuracy of dimension and compressive strength of brick
2. To determine the consistency of cement sample.
3. To determine the workability of concrete
4. To perform plane table survey
5. To perform chain and compass survey
6. To verify law of parallelogram of forces
7. To verify the law of triangle of forces
8. To verify the polygon law of forces
9. To verify lami's theorem
10. To verify the law of moments using bell crank lever**.**

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ESC 202	**Basic Mechanical Engineering & Manufacturing Practices**	**2L:1T: 2P (05 hrs)**	**Credits:04**

Prerequisite (s): 10+2 Level Physics, Chemistry

Course Objective: To introduce and learn various aspects of Mechanical Engineering discipline and its applications to society and to inspire students to take up Mechanical Engineering as a career.

Course Content:

Module 1 **(10 hrs)**

Materials: Classification of engineering material, Composition of Cast iron and Carbon steels, Iron Carbon diagram. Alloy steels their applications. Mechanical properties like strength, hardness, toughness, ductility, brittleness, malleability etc. of materials, Stress-strain diagram of ductile and brittle materials, Hooks law and modulus of elasticity, Introduction to UTM.

Module 2 **(12 hrs)**

Production Engineering: Elementary theoretical aspects of production processes like casting, carpentry, welding, Black smithy, fitting, Introduction to Lathe and Drilling machines and their various operations. Concept of measurements, errors in measurement, Temperature, Pressure, Velocity, Flow strain, Force and torque measurement, Vernier caliper, Micrometer, Dial gauge, Slip gauge, Sine-bar and Combination

Module 3 **(10 hrs)**

Fluids and Thermal Science: Fluid properties. Types of fluids , Newton's law of viscosity , Pascal's law, Bernoulli's equation for incompressible fluids, Only working principle of Hydraulic machines, Thermodynamic system, properties, state, process, zeroth's, first and second law of thermodynamics.

Module 4 **(9 hrs)**

Power Engineering: Classification and working of boilers, mountings and accessories of boilers, Efficiency and performance analysis, formation of steam & its properties, Working of Two stroke & Four stroke Petrol & Diesel engines.

Module 5 **(9 Hrs)**

Industrial Engineering and Automation: Introduction to product design, linear programming problem formulation, Break-even analysis, Introduction to forecasting, Ergonomics, Basic concepts of CAD/CAM.

Course Outcomes:

After completion of the course, the students are able to:

1. Define the Engineering Material, Properties and applications and list the various test on materials by UTM.
2. Demonstrate the working of different measuring instruments and to introduce various manufacturing processes.
3. Identify the Fluid properties, its laws and understand the basic concept of first and second Law of Thermodynamics.
4. Evaluate and analyze performance characteristics of Boilers.

5. Identify product design and significance of Ergonomics and able to perform break even analysis; understand significance of automation in manufacturing.

Text Book/ References:

1. Basic Mechanical Engineering, by C.M. Agrawal, Basant Agrawal, Publisher: Wiley 2008.
2. Basic Mechanical Engineering by Sadhu Singh, Publisher : S Chand 2009
3. Kothandaraman & Rudramoorthy, Fluid Mechanics & Machinery, New Age, 2007 .
4. Nakra & Choudhary , Instrumentation and Measurements, TMH,2003
5. Nag P.K, Engineering Thermodynamics, TMH, 2010.
6. Ganesan , Internal Combustion Engines, TMH, 2008
7. M.I. Khan, Industrial Engineering, New Age International, 2004

List of Experiment:

1. To perform a tensile test on UTM.
2. To prepare a job in a Carpentry Shop.
3. To prepare a job in a Fitting Shop.
4. To prepare a job in Black Smithy.
5. To prepare a job in Welding Shop.
6. To verify Bernoulli's Theorem using Bernoulli's apparatus
7. Study of Boilers, their Mounting and Accessories.
8. Study of Two and Four Stroke SI Engine.
9. Study of Two and Four Stroke CI Engine.
10. To perform Break Even Analysis of a case study.
11. To study the working of Lathe & Drilling Machines.

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ESC 203	Electronics and Computer Workshop	0L:0T:2P (2 Hrs)	1 Credits

Course Objective: The course objectives are to identify different electronic components, devices, making circuit on bread board and PCB using simple ICs and components and testing, to assemble Desktop and installation of OS and downloading of OS image on Raspberry Pi board.

(Part A) Electronics

Module I: (7 hrs.)

Introduction to various electrical passive components such as R, C, L, transformers, relays, switches, bread board, universal printed circuit board and electronic devices such as rectifying diode, Zener diode, light emitting diode, transistor, seven segment displays, LCD panel, Integrated circuit chip (with different packages and functionalities, both digital and analog) and Surface mount devices/chips. Acquaintance with ratings, specifications, packages of components and devices listed above, using data-sheets.

Module II: (6 hrs.)

Exposure to usual electronic equipment/instruments such as Multi-meter, Oscilloscope, Function generator, IC tester and Power supply, Information about their front panels, Demonstrations on their working, Hands-on for measurement of component values and DC voltage using multi-meter, AC mains voltage/ 1 KHz Square wave/any small signal from function generator on Oscilloscope, Testing of sample digital ICs using IC tester.

Module III: (6 hrs.)

Circuit building practice on standard bread board using simple ICs, components and single strand wires, performing cold test and functionality verification wherever possible. Soldering and de-soldering practice on universal PCBs using solder guns/stations/de-soldering pumps, for components/devices/ICs.

Module IV: (5 hrs.)

Simple electronic circuit design in a team of 3-4 students, designing of single sided PCB using PCB-CAD software, PCB fabrication process, component mounting and soldering.

Example of projects:

- IC 555 based timer and square wave generator
- OP-amp IC 741 based analog computer (adder/subtractor/integrator/differentiator)
- FM remote lock for vehicle
- Digital Clock
- Temperature sensor and display

(Part B) Computer

Module I: (6 hrs.)
Name and identify various PC hardware components: USB Mouse, PS/2 Mouse, Keyboard, LCD/LED Monitor, VGA, HDMI, CAT5, CAT6, server, routers, fiber cable, Hard disk, RAM, CMOS battery, SMPS, cache, ROM, BIOS

Module II: (8 hrs.)
Introduction to various important software: Ubuntu, Windows, Mac, Microsoft Office; Firefox, Google Chrome, Edge; Linux Command Line (few basic commands); Photoshop, Gimp Understand the broad structure and functioning of the Internet; Introduction to: LAN, DNS, Proxy, Router, Hub, Switch, Server, Client, Website, Webserver; Understand basic networking commands, applications and services: ssh, telnet, ftp, winscp, ping, http, https, various search services (google, startpage, aggregator search services) LAN cable by using crimping tools.

Module III: (4 hrs.)
Assemble a Desktop PC from it's components, Dual boot OS installation, Windows 10, LAN Network creation.

Module IV: (6 hrs.)
Setup a working desktop system using a Raspberry Pi board. Download the OS image from web. Installation of OS like: Raspbian, Ubuntu Mate, Openelec, OSMC, Pidora, RISC OS, Arch Linux ARM, etc.

Course Outcomes:

Students earning credits will develop ability to:

1. Identify various electronic components and use of electronic devices and instruments.
2. Design and test simple electronic circuit on PCB.
3. Know hardware components of computer systems, various software and hardware terms and their uses.
4. Build dual boot machine with two different OS.
5. Creating a LAN network for PCs and learn to solve various problems with computer.

Textbooks/References:

1. Ian r. Sinclair and john dunton, “practical electronics handbook”, 6th Edition,2007.
2. Allen Mottershed, “Electronic Devices and Circuits", 2ndEdition,2003.
3. Colin Bentley, “Prince 2: A Practical Handbook: A Practical Guide (Computer Weekly Professional)”, 2nd Edition,1997.

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HSMC 101	English	2L:0T:2P (4 Hrs)	3 Credits

Course Objectives: To make students proficient in English; to enable them to participate actively in various competition that require knowledge of English and the skills to use this knowledge to communicate their ideas and creative thinking in a variety of formats**.**

Course Contents:

Module-I: Basics of Grammar (10 Hours)

Parts of Speech, Tenses, Articles, Subject-Verb Agreement, Prepositions, Active and Passive Voice, Reported Speech: Direct and Indirect, Types of Sentences, Accuracy and Appropriateness

Module-II: Vocabulary Development (10 Hours)

Acquaintance with Prefixes and Suffixes in English, Synonyms, Antonyms, One Word Substitution, Homophones, Homonyms and Analogy

Module- III: Reading Skill (10 Hours)

Introduction and Benefits of Reading, Mechanism of Reading, Techniques of Reading (SQ3R method), Reading Comprehension, Cloze Passages, Para Jumbled

Module- IV: Writing Skill (10 Hours)

Introduction and Essentials of Formal Writing, Planning, Drafting and Editing, Précis writing, Methods of Abridging of Sentences, Paragraph Writing, Paraphrasing & Summarizing, Blog Writing, Slogan Writing, Article Writing , Feature Writing

Module –V: Learning Language through Literature (10 Hours)

1. Non Fiction: Sapiens A Brief History of Humankind by Yuval Noah Harari
2. Novella : "Animal Farm" by George Orwell
3. Autobiography & Bipgraphy: Elon Musk, Stephen Hawking, Ratan Tata, APJ Abdul Kalam, Steve Jobs
4. Poem: Nissim Ezekiel's "Night of the Scorpion"

   Student will select literature and do the assigned work under the mentorship of a teacher individually or in group.

Course Outcomes:
The student will be able to construct sentences of English with accuracy by learning basics of English so that they can be able to write and express in a better way.

Textbooks/ References:

1. Murphy's English Grammar by Raymond and Murphy: Cambridge University, New Delhi, 2008.
2. Remedial English Grammar by F.T. Wood, Macmillan, 2007.
3. Essential English Grammar by Raymond and Murphy, Cambridge University, New Delhi, 2012.
4. English for Effective Communication by Sanjay Kumar and Pushp Lata: Oxford University Press, New Delhi 2015.
5. English Language Skills by Aruna Koneru: McGraw Hills Education (India) Pvt. Ltd., New Delhi, 2015.
6. Collected Poem 1952-1988,Nizim Ezekiel, Oxford University Press,1989
7. A Brief History of Humankind by Yuval Noah Harari HarperCollins Publishers,2017
8. Animal Farm by George Orwell, Standard Edition,1996
9. Aarts, Bas (2011). Oxford Modern English Grammar, New York: Oxford University Press
10. Ajmani, J. C. Good English: Getting it Right. New Delhi: Rupa Pubications, 2012.
11. Collins, Patrick. Speak with Power and Confidence. New York: Sterling, 2009.
12. Dhanavel, S.P. (2010). English and soft skills (V-1). Chennai: Orient Blackswan.
13. Fitikides, T. J. Common Mistakes in English. London: Orient Longman, 1984.
14. Rutherford, Andrea J. Basic Communication Skills for Technology: Second Edition. Delhi: Pearson Education, 2007.

English Lab

1. Listening Comprehension and its interpretation (Audio will be selected by the instructor)

2. Situational Conversation: Conversation through dialogue practice based on various situations.

3. Reading Comprehension: Intensive Reading Skill, Rapid Reading and Reading Aloud.

(Note: Reading material to be selected by the teacher.)

4. Speaking Skills: Oral Presentation, Extemporary, JAM, Group Discussion

5. Resume Writing: Preparation of Digital Resume & Video Resume

Optional: Developing Critical Thinking through Film Review or Book Review

6. Practice session through Wordsworth Software in Language Lab.

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BSC-102	Optics and Modern Physics	2L:1T:2P (5 Hrs)	4 Credits

Pre-requisites: Mathematics course with integral and differential calculus.

Course Objectives: To impart knowledge in basic concepts of physics relevant to technological applications, and apply laws of physics to real world problems.

Course Content:

Module I: Quantum Physics (10 Hours)
Introduction to Quantum mechanics, Dual nature of matter, Properties of wave function, phase and group velocities, Heisenberg's uncertainty principle with its elementary proof and applications, Derive energy and momentum operators, Time dependent and independent Schrodinger equation, Particle in one dimensional box.

Module II: Wave Optics (10 Hours)
Interference of light, Young's double slit experiment, Newton's rings, Fraunhofer diffraction from single slit and N-Slit diffraction grating, Concept of Polarization, Brewster's law, Double refraction, Nicol prism, uses of Polaroid.

Module III: Theory of Semiconductors and Superconductors (10 Hours)
Band theory of solids, density of states, Fermi Dirac distribution function, Fermi level in intrinsic and extrinsic semiconductor, working principle of Solar Cell and Photo diode, Hall Effect, Introduction to superconductivity, persistent currents, Meissner effect, Type-I and Type-II superconductors,

Module IV: Lasers (10 Hours)
Properties of laser beams, Einstein's theory of matter radiation interaction and A and B coefficients, explain conditions to achieve lasing action, basic parts of a laser, different types of lasers, gas laser (He-Ne and CO_2), solid state laser (Ruby, Neodymium), applications of lasers.

Module V: Fiber Optics (10 Hours)
Introduction to optical fibers, calculation of acceptance angle, acceptance cone, numerical aperture, V-number, No. of Modes and attenuation in optical fibers, explain types of optical fibers, losses in fiber, Fiber optics communication system, applications of optical fibers.

Course Outcomes:

CO1: To **e**xplain fundamentals of quantum mechanics, and apply to phase velocity, group velocity, and particle in one dimensional box.

CO2: To analyze the intensity variation of light due to polarization, interference and diffraction, and derive intensity expression in single slit, N-slit diffraction grating. Calculate radius of curvature of lens in using Newton's ring experiment.

CO3: To explain theory of semiconductors and superconductors and apply to solar cells, photo diode, Hall Effect and Meissner effect.

CO4: To drive relation between Einstein's A's and B's coefficients, and explain working principle of different types of lasers.

CO5: To state the principle of optical fiber and calculate acceptance angle, numerical aperture, V-number, No. of modes, apply to fiber optic communication system.

Textbooks/ References

1. Gaur and Gupta, Engineering Physics, Dhanpat Rai Publications.
2. H. K. Malik and A. K. Singh, Engineering Physics, Mc Graw Hill Education.
3. Dr. S. L. Gupta and Sanjeev Gupta, Engineering Physics, Dhanpat Rai Publications
4. Navneet Gupta, Engineering Physics, Dhanpat Rai Publications
5. Dr. R. Dogra, Engineering Physics, Katson Books
6. C. Kittel , Introduction to solid state physics, Wiley
7. Beiser, Concepts of Modern Physics, TMH
8. R. P. Goyal, Unified Physics, Shivlal agarwala & Co.
9. K. Thyagarajan, Ajoy Ghatak, Lasers: Fundamentals and Applications, Springer Science and Business Media.
10. O. Svelto, Principles of Lasers, Springer

List of Experiment

1. To determine wavelength of given laser light source.
2. To determine the radius of curvature of given plano convex lens with the help of a plane Newton's ring experiment.
3. To determine the wavelength of main spectral lines of given mercury light with help of a transmission grating.
4. To determine refractive index and dispersive power of the material of given prism using spectrometer.
5. To plot forward and reverse characteristics curve of P-N junction diode.
6. To determine the divergence of He-Ne Laser.
7. To find numerical aperture of a given optic fibre and hence to find its acceptance angle.
8. To verify Brewster's law using polarizer.
9. To determine the Hall voltage and charge carrier density, in semiconductor using Hall effect experiment.
10. To plot forward and reverse characteristics curve of zener diode.

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ESC 101	Engineering Graphics &Visualization	3L: 0T: 2P (05 hrs)	Credits:04

Course Objectives:

- To know about Basics of dimensioning ,Lettering& representation of lines, different types of lines & use of different types of pencils in an Engineering Drawing
- To know about different types of projection & to know projection of points, straight lines.
- To know about projection of plane & solids.
- To know section & development of lateral surface of different solids.
- To know about isometric projection. To learn Auto CAD.

Course Content:

Module 1 **(10 hrs)**

Introduction: Need & Classification of Engineering Drawings, Drawing Instruments and their uses, Indian Standards for Drawing, Drawing Sheet Layout, Various conventions used in drawing as per BIS norms, Technical Lettering, Dimensioning, Basic Geometrical Constructions.
Scales: Engineering scale, graphical scale, plain scale, diagonal scale, comparative scale, scale of chord.
Geometric Constructions and Engineering Curves: Division of lines, curves, angles and other simple construction elements. Conic sections: parabola, ellipse and hyperbola. Spiral, Involute and Cycloidal curves.

Module2 **(08 hrs)**

Orthographic Projections: Drawing orthographic projections from pictorial Projections, By using first angle projection method.
Projection of Point: Including points in all four quadrants
Projection of Lines: Line parallel to reference plane, perpendicular to reference plane, inclined to one reference plane, inclined to both reference planes, traces of line.

Module3 **(12 hrs)**

Projection Plane Surfaces: Projections of planes parallel to one of the reference planes, Projections of planes inclined to one reference plane and perpendicular to the other & Projections of oblique planes, Auxiliary planes.
Projection of Solids: Classification of solid, Projections of solids in simple and complex positions of the axis.

Module 4 **(10 hrs)**

Section of Solids: Sectional views and true shape of the section.
Development of Surfaces: Methods of developments, development of various solids, transition pieces, spheres.
Interpenetration of Solids: Interpenetration of geometrical solids Like Two prisms, two cylinders.

Module 5 **(10 hrs)**

Isometric Projections: Isometric view, Isometric scale to draw Isometric projection, Non Isometric lines, construction of isometric view from given orthographic views and to construct Isometric view of a Pyramid, Cone, Sphere.

Auto CAD: Introduction to Computer Aided Drawings, Drawing of Machine elements like Riveted Joints, Screw fasteners and Welded Joints in Auto CAD.

Course Outcomes:

After completion of this course, the student will be able to:

1. Read and write the language of Engineering Graphics to study its basic theory and to be familiar with its accepted conventions and abbreviations.
2. Prepare neat orthographic drawings of points, straight lines, and regular planes and solids.
3. Prepare neat drawings of projection of regular planes and solids.
4. Understand application of section, development and penetration of solids.
5. To be able to plan and prepare neat isometric drawings of regular planes and solids and hands on practice on Auto CAD.

Text Book/ References:

1. Bhatt N D, Engineering Drawing, Charoter Publishing House, Anand, Gujrat ,53rd Edition. 2014
2. Agrawal B, and Agrawal C M, Engineering Drawing, Tata McGraw-Hill Publishing Company Limited. 3rd Edition, 2019
3. Dhawan R.K. Engineering Drawing, S. Chand Publication.2012
4. French T E, Vierck C J, Foster R J, Engineering. Drawing and Graphic Technology Mc Graw-Hill International, Singapore, 4th Ed., McGraw Hill,1984
5. Luzadder W J, Duff J M, Fundamentals of Engineering Drawing, Prentice- Hall India, New Delhi. Eleventh Edition, 1983.
6. Dhananjay A Jolhe, Engineering drawing, Tata McGraw Hill. 2017
7. Shah M B and Rana B C , Engineering Drawing, Pearson Education, New Delhi.2nd Edition, 2019

List of Experiment:

Preparation of drawing sheets containing the drawings for topics covered in theory.

IPS Academy, Institute of Engineering & Science

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ESC102	Basic Electrical and Electronics Engineering	2L: 1T: 2P (5 hrs.)	4 credits

Pre requisite: To study an electrical engineering, students will need a strong background in Complex algebra, Electric charge and Electromagnetic induction.

Course Objective: The course objectives are imparting a basic knowledge of AC & DC terminologies and highlight the importance of Electrical Machines and instruments. It also provides the information about to the fundamental of semiconductors, electronics devices, introduction of Integrated circuits and VLSI.

Course Content:

Module 1: DC Circuits and Magnetic Circuits (10 hrs.)

DC Circuits: Active and passive elements, Dependent and Independent sources, Voltage and current sources, source transformation, Voltage divider and current divider rules, Ohm's Law, Kirchoff's Law: Loop and Nodal methods of analysis,Star-delta transformation,Energy and power in elements, Charging and discharging of capacitor;Network theorems:Superposition theorem, Thevenin's theorem.

Magnetic Circuits: M.M.F., Field strength, Flux density, Reluctance, Comparison between electric and magnetic circuits, Energy stored in magnetic circuits, Magnetic circuits with air gap, B-H curve,hysteresis and eddy current losses, Numerical problems on series magnetic circuits.

Module 2 Single phase AC circuits and Three phase AC Circuits (10 hrs.)

Single phase AC circuits: Generation of alternating voltages, AC circuit terminologies,Phasor Representation of an alternating quantity, Behavior of AC circuit containing pure R, L, and C; Impedance and admittance concept; Power in single phase circuit - Concepts of active, reactive and apparent power; power factor;Analysis of R-L, R-C, R-L-C circuits,Resonance in series and parallel RLC circuit, Q- factor and bandwidth.

Three phase AC Circuits: Generation of three phase voltages, Advantages of three phase system, Phase sequence, Relationship between line and phase quantities for balanced star and delta connectedloadsand Power measurement in three phase circuit.

Module 3: Introduction to Electrical Machines (10 hrs.)

Static Electrical Machines: Classification**,** construction and working principle of transformer,transformer ratings, E.M.F. equation, Equivalent circuits,phasor diagram, Voltage regulation, Losses and efficiency.

Rotating Electrical Machines- classification**,** construction, working principle and applications of DC machines, single and three phase Induction machines, and Synchronous machines.

Module 4: Introduction to Measuring Instruments and Circuit Protection Devices (10 hrs.)

Voltmeter, ammeter, wattmeter,multi-meter and energy meter; Fuses, Miniature Circuit Breaker and Electronic fan regulator.

Introduction to semiconductor fundamentals**:** Intrinsic and extrinsic semiconductors, Fermi Level; Carrier transport phenomenon- Generation, recombination and injection of carriers; transient and steady state response; Basic governing equations in semiconductors.

Module 5: Basic Electronics (10 hrs.)

Physical description of p-n junctions, Transport equations, current-voltage characteristics, Temperature dependence of the p-n characteristics; Diode- V-I characteristic, types of diodes, and applications; Bipolar Junction Transistors: Working principle, Modes of operation and different configurations; Introduction of simplecircuits using common Analog IC like LM-741 Op-amp, NE-555 Timer and 78/79xx Voltage regulator; Introduction to Field Effect transistor (FET), Integrated circuits (ICs), Large Scale Integration(LSI) and Very Large Scale Integration (VLSI).

List of Experiments

1. To verify Superposition theorem in a DC circuit.
2. Verification of Thevenin's Theorem in a DC circuit.
3. To determine the value of resistance and inductance of a choke coil.
4. To experimentally determine the resonance frequency in a series RLC circuit and compare this to the expected resonance value.
5. Measurement of three phase AC power by Two-Wattmeter method.
6. To perform the open circuit test and short circuit test of a single phase transformer.
7. To perform Load Test on single phase transformer for determining the efficiency & voltage regulation.
8. Constructional study of rotating electrical machines.
9. To observe the Voltage-Current relation in Diodes by applying a voltage across it and measuring the corresponding current flowing through it.
10. To observe the transistor characteristics in CE-configuration.

Course Outcomes: Students will be able to

CO1: understand the basic concepts of DC and magnetic circuits.

CO2: explain single and three phase AC Circuits.

CO3: understand the principle of operation and then analyze the working of electrical machines.

CO4: impart the knowledge of electrical measuring instruments and circuit protection devices.

CO5: explain the operating principle of semiconductors

Textbooks/ References

1. D.P. Kothari, I.J. Nagrath, "Basic Electrical Engineering", TMH Publishing Co. Ltd., New Delhi, 3rd edition.
2. Leonard S. Bobrow, "Fundamentals of Electrical Engineering", 2nd Edition, Oxford Press.
3. A.E. Fitzgerald, D.E. Higginbotham, "Basic Electrical Engineering", McGraw Hill Book Co., New York, 2nd edition.
4. Dr. S. L. Uppal, "Electrical Wiring, Estimating and Costing", Khanna Publishers.
5. Hughes Edward (revised by Ian McKenzie Smith), "Electrical Technology", Seventh Edition, English Language Book Society Publication with Longman, 1995.
6. Del Torro, Vincent "Electrical Engineering Fundamentals" Second Edition, Prentic Hall of India Pvt. Ltd. 1994.

7. Cotton H. “Advanced Electrical Technology”, Issac Pitman, London, 1967.
8. Cogdell, J.R. “Foundations of Electrical Engineering”, Second Edition, Prentice Hall, 1996.
9. V. N. Mittal and Arvind Mittal, “Basic Electrical Engineering” McGraw Hill.
10. J.B. Gupta, “Basic Electrical and Electronics Engineering”, Publisher : S.K. Kataria & Sons; Edition : 6th 2011; Reprint : 2020.
11. R S Muller, T.I.Kamins, Device Electronics for Integrated Circuits, 3rd edition, Wiley-India, New Delhi, 2012.

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ESC 103	Programming for Problem Solving	3L : 0T : 2P (5 hrs.)	4 credits

Course Objective: To understand the programming concepts and build the logics according to given problems.

Course Content:

Module 1: Basics of C programming (11 hrs.)

History of C Language, Applications of C language, A Structure of C program. Data types, The C Character Set, Variables, Keywords, Constants, C Instructions, ,Operators, Precedence and Associativity of Operators, Storage Classes in C ,Introduction to Input/Output, Control statements and Jump Statements.

Module 2: Functions and Arrays (10 hrs.)

Introduction to Functions, Function Declaration and definition, Function with Arguments, Function with Returning Values, Recursion. Arrays: Declaring and Initializing, 1- D array, Multi Dimensional Arrays.

Module 3: Pointers and String (12 hrs.)

Pointers, Pointer variables, Pointer operators ,Pointer Expressions ,Pointer and arrays, Call by Value and Call by Reference, Passing Array to Functions, Passing strings to functions, Array of pointers, Pointer to an array, Pointers to Functions and its uses, dynamic memory allocation. Strings: Declaring and Initializing Strings, Operations on Strings, Array of Strings.

Module 4: Aggregate Data Types (8 hrs.)

Structures-Declaring and Initializing, Passing Structures to functions, Array of Structure, Array within Structures, pointers and structures, ,Uses of Structures. Unions, enum.

Module 5: Files, Preprocessor Directives and Advance Topics (9 hrs.)

Files - File modes, File functions, and File operations, Text and Binary files, Command Line arguments. C Preprocessor directives, Creating and implementing user defined header files.

Course Outcome:

1. Recognize programming concepts
2. To decompose a problem into functions and Using Array
3. Use pointers and memory allocation to write C programs
4. Implement Structures and Unions for data organization
5. Use files to perform read and write operations.

Textbooks / References:

1. Kerninghan & Ritchie “The C programming language” 2nd Ed., PHI,
2. Schildt “C: The Complete reference” 4th Ed. TMH.
3. Kanetkar Y. “Let us C”, BPB Publications, 2004
4. Kanetkar Y.: “Pointers in C” , BPB Publications, 2007
5. Stephen Parata “C Primer Plus” 5th Ed., Sams, 2004

6. Paul Deitel and Harvey Deitel "C How to Program ", 6th Ed., Pearson, 2010

List of Experiments:

Write a C program:

1. To display "Hello Computer" on the screen.
2. To display Your Name, Address and City in different lines.
3. To find the area and volume of sphere. Formulas are: Area = 4*PI*R*R Volume = 4/3*PI*R*R*R.
4. To print the multiply value of two accepted numbers.
5. To convert centigrade into Fahrenheit. Formula: C= (F-32)/1.8.
6. To read in a three digit number produce following output (assuming that the input is 347)
   3 hundreds
   4 tens
   7 units
7. To find out whether the character presses through the keyboard is a digit or not (using conditional operator).
8. To swap variable values of i and j.
9. To find the maximum from given three nos.
10. To find that the accepted no is Negative, Positive or Zero.
11. For calculator designing using switch /case loop?
12. To find the sum of first 100 natural nos.
13. To display first 100 prime numbers.
14. To find factorial of accepted numbers.
15. To find the sum of digits of accepted no.
16. To find minimum, maximum, sum and average of the given one dimensional array.
17. Function for the following task
    Find value of a given Fibonacci term
    Swapping the values of two variable
    Minimum/maximum value from the given input
18. To add two numbers using pointers.
19. To create a file and write contents, save and close the file.
20. To read file contents and display on console.

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MC 2	Rural Outreach	0L:0T: 4P	0 Credits

Field work: 08 Hrs; **Other than field work: 16 Hrs**

Course Objective: To instill interest and concern among the students about the dynamics of rural society, to develop community based learning, help the students to identify and respond to community needs, Give insights of broader social issues and its impact on rural communities, inculcate value and multiple perspectives of problem solving and foster students' intellectual capabilities. Apply critical thinking skills in problem solving with social work values and ethics, on diverse human issues for rural solution engineering.

Content:

1. Studying the community set up in detail and developing an in-depth understanding of the field and reporting their study in the form of special report.
2. Practicing social case works with a minimum of 2 individuals; identify the problem, study, assess and develop intervention strategies for all the cases and execute the plan of intervention.
3. Working with the community by involving them on one or two issues/problems by confronting the concerned community.
4. Making a minor research study on any specific problem and submitting the report as part of field work.
5. Taking part in the programmes, seminars, workshops, etc. related to community work for the enrichment of knowledge. (With the prior permission of the Faculty supervisor).

Methodology of Field Work

The following are some important modes of learning in field work:

1. Observation
2. Informal interactions with community
3. Participatory Rural Appraisal and Participatory Learning Appraisal Methods
4. Case Discussions/Conferences
5. Sharing of experiences both among the team members and the teams
6. Additional field work if necessary

Course Outcomes:

1. Develop skills to understand the social, economic, political and cultural framework of the rural society.
2. Develop skills to address the challenges with suitable responses for the identified rural issues.
3. Develop skills to engage in the management of the rural community.
4. To provide the technical solution of the problems identified in the villages related to Health, Education, Agriculture, Water and Sanitation.
5. To conduct social research to evaluate the social world interventions, as well as to evaluate agency and community practice for the progress of village.