

**Course Code: BSC101**

**Course Name: Physics**

<b>Programme:</b> B.Tech.	<b>L: 3 T: 1 P: 0</b>	<b>Credits: 4</b>
<b>Semester: 1,2</b>	<b>Theory/Practical:</b> Theory	<b>Teaching Hours:</b> 39(L)+13(T)= 52 hrs
<b>Total Max. Marks:</b> 100	<b>Continuous Internal Assessment (CIA) Marks:</b> 40	<b>End Semester Examination (ESE) Marks:</b> 60
<b>Minimum percentage of Numerical / Design / Programming Problems:</b> 20%-30%		
<b>Duration of End Semester Examination (ESE):</b> 3 hours		
<b>Course Type:</b> Basic Science		

**Prerequisites: NIL**

**Additional Material Allowed in ESE:** Scientific Calculator is allowed

**On Completion of the course, the student will have the ability to:**

<b>CO#</b>	<b>Course Outcomes</b>	<b>POs</b>	<b>PSOs</b>
1	Apply the knowledge of vector calculus and operators to solve complex problems in the field of Electromagnetism, Superconductivity and Quantum Mechanics.	1(3)	-
2	Understand the physical principles involved in the working of various devices viz., Lasers, Optical fibers, Semiconductors, Superconductors etc.	1(2)	-
3	Interpret the effect of various physical parameters and addition of impurities on the behaviour of different materials and devices.	1(1)	-
4	Predict and conclude about the possible outcomes of physical processes.	2(1)	-
5	Identify the most suitable devices for different applications in the field of Science and Technology.	2(1)	-

**Detailed Contents:**

**Part-A**

**Unit-1 Basics of electromagnetic theory:**

**7+2(T) = 9 hours**

Concept of Gradient, Divergence and Curl, Relation between Electric Field and Potential, Statements of Gauss divergence theorem and Stoke's theorem, Maxwell's equations in integral form (without derivation), Derivation of Maxwell's equations in differential form, Physical significance of Maxwell's equations, Electromagnetic wave equation in vacuum and conducting media.

**Unit-2 Laser:**

**6+2(T) = 9 hours**

Characteristics of Lasers, Absorption, Spontaneous and Stimulated Emission, Einstein's coefficients and relation between them, Population inversion, Metastable state, Types of pumping, Construction and working of: Ruby Laser, He-Ne Laser and CO<sub>2</sub> Laser, Applications of Lasers.

**Unit-3 Fiber optics:**

**7+2(T) = 9 hours**

Introduction to fiber optics, Construction of optical fiber, Propagation mechanism, Types of optical fiber, Acceptance angle, Numerical aperture, V-number, Attenuation and dispersion losses in optical fiber, (Qualitative idea), Applications of optical fibers.

### **Part-B**

#### **Unit-4 Quantum Mechanics:**

**7+3(T) = 11 hours**

Need of quantum mechanics, Wave-particle duality, de-Broglie hypothesis, Phase velocity and group velocity, Wave Function-Properties, Physical significance, normalization, Eigen functions and eigen values, Time independent and time dependent Schrodinger wave equations, Energy and momentum operators, Expectation values of physical quantities (Position, momentum and energy), Particle in a one-dimensional box. Introduction to Quantum Computing (Qualitative Idea)

#### **Unit-5 Semiconductors:**

**6+2(T) = 9 hours**

Formation of bands in solids, Bloch theorem and Bloch function (only definition), Effective mass of electrons, Density of energy states, Fermi level, Position of Fermi level in intrinsic and extrinsic semiconductors, Conductivity of intrinsic and extrinsic semiconductors, Diffusion and drift current, Introduction to LED & Solar cell and their applications.

#### **Unit-6 Superconductivity:**

**6+2(T) = 6 hours**

Introduction to superconductivity, Critical magnetic field, Silsbee's rule, Meissner effect, Isotopic effect, Type-I and type-II superconductors, Cooper pairs, Electrodynamics of superconductors, penetration depth, specific heat, BCS theory, Coherence length, high temperature superconductors, Applications of superconducting materials.

#### **Text Books:**

1. M. N. Avadhanulu, "A Text Book of Engineering Physics", S. Chand Publishers, 11<sup>th</sup> edition, 2019.
2. M. N. Khan, S. Panigrahi, "Principles of Engineering Physics" (Vol. I & II), Cambridge University Press, 1<sup>st</sup> edition, 2016
3. D. R. Joshi, "Engineering Physics", McGraw Hill, 1<sup>st</sup> edition, second reprint, 2014

#### **Reference Books:**

1. D. J. Griffiths, "Introduction to Electrodynamics", Prentice Hall of India, 4<sup>th</sup> edition, 2012.
2. B. B. Laud, "Lasers & Non-Linear Optics", New Age International Ltd., 3<sup>rd</sup> edition, 2015.
3. K. Thyagarajan, A. K. Ghatak, "Lasers: Fundamentals & Applications", Springer, 2<sup>nd</sup> edition, 2010.
4. J. C. Palais, "Fibre Optic Communication", Pearson India, 5<sup>th</sup> edition, 2011.
5. S. M. Sze, "Semiconductor Devices: Physics & Technology", Wiley, 1985.
6. D. J. Griffiths, "Quantum Mechanics", Pearson Education, 2008.
7. Richard Robinett, "Quantum Mechanics", OUP, 2006.
8. B. S. Rajput, "Advanced Quantum mechanics", Pragati Parkashan, 2013.
9. W. D. Callister, "Material Science & Engineering", John Wiley & Sons, 7<sup>th</sup> edition, 2007.
10. D. Wei, "Solid State Physics", Cengage Learning, 1<sup>st</sup> edition, 2008.
11. M. Tinkham, "Introduction to Superconductivity", Dover Publications, 2<sup>nd</sup> edition, 1996.

#### **Online Learning Materials:**

1. <https://ocw.mit.edu/courses/6-013-electromagnetics-and-applications-spring-2009/pages/lecture-notes/>  
Accessed on June 11, 2024
2. <https://ocw.mit.edu/courses/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/resources/fiberoptics-fundamentals/>  
Accessed on June 11, 2024

3. <https://ocw.mit.edu/courses/8-04-quantum-physics-i-spring-2016/pages/lecture-notes/>

Accessed on June 11, 2024

4. <https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2009/pages/lecture-notes/>

Accessed on June 11, 2024

5. <https://ocw.mit.edu/courses/6-763-applied-superconductivity-fall-2005/pages/lecture-notes/>

Accessed on June 11, 2024

**Alternative NPTEL/SWAYAM Course:**

S. No.	NPTEL Course Name	Instructor	Host Institute	URL
1	Introduction to Electromagnetic Theory (Hindi)	Prof. Manoj Harbola	IIT Kanpur	<a href="https://onlinecourses.nptel.ac.in/noc24_ph37/preview">https://onlinecourses.nptel.ac.in/noc24_ph37/preview</a>
2	Electromagnetic Theory	Prof. Pradeep Kumar K	IIT Kanpur	<a href="https://onlinecourses.nptel.ac.in/noc24_ee137/preview">https://onlinecourses.nptel.ac.in/noc24_ee137/preview</a>
3	Introduction to LASER	Prof. M. R. Shenoy	IIT Delhi	<a href="https://onlinecourses.nptel.ac.in/noc24_ph45/preview">https://onlinecourses.nptel.ac.in/noc24_ph45/preview</a>
4	Fiber Optic Communication Technology	Prof. Deepa Venkitesh	IIT Madras	<a href="https://onlinecourses.nptel.ac.in/noc24_ee131/preview">https://onlinecourses.nptel.ac.in/noc24_ee131/preview</a>
5	Foundations of Quantum Theory: Non-Relativistic Approach	Prof. Sandeep K. Goyal	IISER Mohali	<a href="https://onlinecourses.nptel.ac.in/noc24_ph38/preview">https://onlinecourses.nptel.ac.in/noc24_ph38/preview</a>

6	Introduction to Semiconductor Devices	Prof. Naresh Kumar Emani	IIT Hyderabad	<a href="https://onlinecourses.nptel.ac.in/noc24_ee99/preview">https://onlinecourses.nptel.ac.in/noc24_ee99/preview</a>
7	Concepts in Magnetism and Superconductivity	Prof. Arghya Taraphder	IIT Kharagpur	<a href="https://onlinecourses.nptel.ac.in/noc24_ph28/preview">https://onlinecourses.nptel.ac.in/noc24_ph28/preview</a>

# Guru Nanak Dev Engineering College, Ludhiana

An Autonomous College under UGC Act 1956

## B.Tech. 1<sup>st</sup> Year (Common for all Branches)

Course Code: LBSC101

Course Title: Physics Laboratory

<b>Programme:</b> B.Tech.	<b>L: 0 T: 0 P: 2</b>	<b>Credits:</b> 1
<b>Semester:</b> 1,2	<b>Theory/Practical:</b> Practical	<b>Teaching Hours:</b> 26 Hours
<b>Total Max. Marks:</b> 50	<b>Continuous Internal Assessment (CIA) Marks:</b> 30	<b>End Semester Examination (ESE) Marks:</b> 20
<b>Duration of End Semester Examination (ESE):</b> 3 hrs		
<b>Course Type:</b> Basic Science		

**Prerequisites (if any):** NIL

**On completion of the course, the student will have the ability to:**

CO#	Course Outcomes
1	Verify underlying concepts and laws of Physics responsible for various phenomenon and processes.
2	Evaluate the performance and accuracy of various devices/instruments.
3	Verify the properties of materials using different experimental techniques
4	Apply the laws of optics to measure very short distances.
5	Classify materials by observing their behaviour under different conditions.

### Contents

Experiment No.	Experiment Title
1.	To determine the value of Planck's constant by using photo electric effect.
2.	To verify the inverse square law of light using photo electric effect.
3.	To determine the dielectric constant of solid samples.
4.	To Trace B-H curve for different ferromagnetic materials using CRO and find out the coercivity and hysteresis loss.
5.	To study diffraction using laser beam and determine the grating element.
6.	To determine the wavelength of a laser beam using the Michelson Interferometer.
7.	To determine the numerical aperture (NA) of an optical fiber.
8.	To measure the propagation loss in optical fiber.
9.	To determine the angle of prism by using spectrometer.
10.	To determine the angle of divergence of laser beam using He-Ne laser.
11.	Determination of resistivity and band gap of a semiconductor by four probe method.
12.	To determine the energy band gap in a semiconductor using a p-n junction diode.
13.	To determine the velocity of ultrasonic waves in water and the compressibility of the water.
14.	To find the frequency of A.C. supply using an electrical vibrator.
15.	To determine the mass susceptibility of paramagnetic solution ( $\text{FeCl}_3$ ) by Quincke's

	method.
16.	To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO.

**Mini Project:** Every student has to do perform open-ended experiment in a group. Each group shall submit project report and give a presentation of the same.

#### Reference Books

1. C L Arora, "Practical Physics", S. Chand & Co., 2010.
2. A course of Experiments with He –Ne Laser – R.S Sirohi (2nd Edition) Wiley Eastern Ltd.
3. Engineering Physics - Laboratory Manual, Dr. D. Zarena, Nitya Publications, 2023.
4. Laboratory Manuals.

#### Online Learning Materials

1. <https://www.youtube.com/watch?v=gDFGj0Iodug> Accessed on April 23, 2024
2. <https://www.youtube.com/watch?v=mJsNXEiwRJs> Accessed on April 23, 2024
3. <https://www.youtube.com/watch?v=Lf2Kk9fP4s8>
4. <https://www.youtube.com/watch?v=9ycQolopz6g>
5. <https://www.youtube.com/watch?v=0WLjrKdw79U>
6. <https://youtu.be/I8sn4LmmwOI>
7. <https://youtu.be/ZzDhpPG-QKkm>
8. <https://youtu.be/zYkuAuQizGI>
9. <https://youtu.be/OffBBSCNYTU>
10. [https://youtu.be/5m7r9fx\\_7Ns](https://youtu.be/5m7r9fx_7Ns)
11. <https://youtu.be/YYt2NGFtFOc>
12. <https://youtu.be/B-eTE7jl5mE>
13. <https://youtu.be/0WLjrKdw79U>
14. <https://youtu.be/PiQYNeLQPos>
15. <https://www.youtube.com/watch?v=a4Fxfjw-ZHG4>

#### Experiments to be performed through Virtual Labs

Sr. No.	Experiment Name	Experiment Link(s)
1	To determine the value of Planck's constant by using photo electric effect.	<a href="https://mpv-au.vlabs.ac.in/modern-physics/Determination_of_Plancks_Constant/">https://mpv-au.vlabs.ac.in/modern-physics/Determination_of_Plancks_Constant/</a>
2	To study diffraction using laser beam and determine the grating element.	<a href="https://ov-au.vlabs.ac.in/optics/Diffraction_Grating/">https://ov-au.vlabs.ac.in/optics/Diffraction_Grating/</a>
3	To determine the wavelength of a laser beam using the Michelson Interferometer.	<a href="https://lo-au.vlabs.ac.in/laser-optics/Michelsons_Interferometer_Wavelength_of_Laser_Beam/">https://lo-au.vlabs.ac.in/laser-optics/Michelsons_Interferometer_Wavelength_of_Laser_Beam/</a>
4	To determine the numerical aperture (NA) of an optical fiber.	<a href="https://bop-iitk.vlabs.ac.in/exp/numerical-aperture-measurement/">https://bop-iitk.vlabs.ac.in/exp/numerical-aperture-measurement/</a>
5	To determine the angle of prism by using spectrometer.	<a href="https://ov-au.vlabs.ac.in/optics/Angle_of_Prism/">https://ov-au.vlabs.ac.in/optics/Angle_of_Prism/</a>

6	To determine the angle of divergence of laser beam using He-Ne laser.	<a href="https://lo-au.vlabs.ac.in/laser-optics/Laser_Beam_Divergence_and_Spot_Size/">https://lo-au.vlabs.ac.in/laser-optics/Laser_Beam_Divergence_and_Spot_Size/</a>
7	Determination of resistivity and band gap of a semiconductor by four probe method.	<a href="https://mpv-au.vlabs.ac.in/modern-physics/Resistivity_by_Four_Probe_Method/">https://mpv-au.vlabs.ac.in/modern-physics/Resistivity_by_Four_Probe_Method/</a>
8	To determine the energy band gap in a semiconductor using a p-n junction diode.	<a href="https://bop-iitk.vlabs.ac.in/exp/energy-band-gap/pretest.html">https://bop-iitk.vlabs.ac.in/exp/energy-band-gap/pretest.html</a>
9	To determine the velocity of ultrasonic waves in water and the compressibility of the water.	<a href="https://hmv-au.vlabs.ac.in/harmonic-motion-waves/Ultrasonic_Interferometer/">https://hmv-au.vlabs.ac.in/harmonic-motion-waves/Ultrasonic_Interferometer/</a>
10	To determine the mass susceptibility of paramagnetic solution ( $\text{FeCl}_3$ ) by Quincke's method.	<a href="https://hmv-au.vlabs.ac.in/harmonic-motion-waves/Quinckes_Method/">https://hmv-au.vlabs.ac.in/harmonic-motion-waves/Quinckes_Method/</a>
11	To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO.	<a href="https://shorturl.at/Acqtt">https://shorturl.at/Acqtt</a>

**Course Code: BSC102**  
**Course Title: Mathematics-I**

<b>Programme:</b> B.Tech.	<b>L: 3 T: 1 P: 0</b>	<b>Credits: 3</b>
<b>Semester: 1<sup>st</sup></b>	<b>Theory/Practical:</b> Theory	<b>Teaching Hours:</b> 39(L)+13(T)= 52 hrs
<b>Total Max. Marks:</b> 100	<b>Continuous Internal Assessment (CIA) Marks:</b> 40	<b>End Semester Examination (ESE) Marks:</b> 60
<b>Minimum percentage of Numerical / Design / Programming Problems:</b> 95%		
<b>Duration of End Semester Examination (ESE):</b> 3 hours		
<b>Course Type:</b> Core/Professional Elective/Open Elective Course		

**Prerequisites (if any):** Basics of Integration and Differentiation.

**Additional Material Allowed in ESE:** NIL

**On completion of the course, the student will have the ability to:**

<b>CO#</b>	<b>Course Outcomes</b>
1	Implementing the concepts of the Taylor series to tackle advanced mathematical and engineering problems and identify indeterminate forms to compute limits.
2	Understand and explain the concepts of differentiability and continuity in the context of multivariable functions.
3	Develop critical thinking and problem-solving skills by applying partial differentiation techniques to complex engineering problems.
4	Understand and explain the basic concepts, terminology, classifications and solutions of ordinary differential equations.
5	Analyze and solve engineering problems involving ODEs to demonstrate the practical application of differential equations in various fields.
6	Study and analyze elementary functions of complex variables to solve trigonometric series and applications of De-Moivre's theorem.

**Contents**

**Part-A**

**Unit-1 Differential Calculus**

**5(L) hrs**

Indeterminate Forms, Taylor and Maclaurin series.

**Unit-2 Partial Differentiation and Its Applications**

**12(L) hrs**

Functions of several variables: Limit and Continuity, Partial differentiation, variable treated as constant, Total derivative, Partial derivatives of composite functions, Change of variables, Partial differentiation of Implicit functions, Euler's theorem, Jacobian.

Applications of partial differentiation: Errors and approximation, Taylor's theorem for functions of two variables, Maxima and minima of functions of two variables, Lagrange's Method of undetermined multipliers.

**Part-B**

**Unit-3 Ordinary Differential Equations and Its Applications**

**12(L) hrs**

First-order first-degree differential equations: Formation of ordinary differential equations by elimination of arbitrary constants; Exact differential equations, Reduction of non-exact differential equations using integrating factors. Applications of first-order first-degree differential equations: Law of natural growth, Law of natural decay, Newton's law of cooling and Simple electric circuits. Linear differential equations of second and higher order: Second and higher-order linear ordinary differential



equations with constant coefficients (Homogeneous and non-homogeneous), Differential equations with variable coefficients reducible to equations with constant coefficients (Euler-Cauchy and Legendre equations). Method of variation of parameter. Applications of higher order linear ordinary differential equations: Simple harmonic motion, RLC-Circuits.

**Unit-4 Complex Numbers and Elementary Functions of Complex Variables** **10(L) hrs**

Complex Numbers (Cartesian/Polar form), De-Moivre's theorem and its applications, root of a complex number, elementary functions: exponential, logarithmic, circular, hyperbolic functions of complex variables, summation of trigonometric series.

**Text Books**

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education (2007), 9<sup>th</sup> Edition.
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill, New Delhi (2010), 11<sup>th</sup> Reprint,.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers (2010), 36<sup>th</sup> Edition.

**Reference Books**

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons (2006), 9<sup>th</sup> Edition.
2. R.K. Jain and S.R.K Iyenger, Advanced Engineering Mathematics, Narosa Publications, New Delhi(2008).
3. T. Veerarajan, Engineering Mathematics for first year, Tata McGraw Hill, New Delhi (2008).
4. Babu, R. Engineering Mathematics, Pearson Education (2009).

**Supplementary NPTEL Course**

Sr. No	Course Name	Instructor	Host Institute	URL
1	Differential equations for engineers	Prof. Srinivasa Manam	IIT Madras	<a href="https://nptel.ac.in/courses/111106100">https://nptel.ac.in/courses/111106100</a>
2	Complex Analysis	Dr. A. Swaminathan, Dr. V. K. Katiyar	IIT Roorkee	<a href="https://nptel.ac.in/courses/111107056">https://nptel.ac.in/courses/111107056</a>

**Course Code: BSC103**  
**Course Title: Mathematics-II**

<b>Programme:</b> B.Tech.	<b>L: 3 T: 1 P: 0</b>	<b>Credits:</b>
<b>Semester:</b> 2 <sup>nd</sup>	<b>Theory/Practical:</b> Theory	<b>Teaching Hours:</b> 39(L)+13(T)= 52 hrs
<b>Total Max. Marks:</b> 100	<b>Continuous Internal Assessment (CIA) Marks:</b> 40	<b>End Semester Examination (ESE) Marks:</b> 60
<b>Minimum percentage of Numerical / Design / Programming Problems:</b> 95%		
<b>Duration of End Semester Examination (ESE):</b> 3 hours		
<b>Course Type:</b>		

**Prerequisites (if any):** Basics of Integration and Differentiation.

**Additional Material Allowed in ESE:** NIL

**On completion of the course, the student will have the ability to:**

<b>CO#</b>	<b>Course Outcomes</b>
1	Understand the geometric significance of MVT and use derivative tests to obtain knowledge about the increasing and decreasing nature of functions as well as concavity to accurately sketch function graphs.
2	Develop a clear understanding of double and triple integrals and apply multiple integrals to find area and volume.
3	Identify and elucidate the salient characteristics of prevalent discrete and continuous probability distributions, including the Poisson, Normal, and Binomial distributions
4	Understand the concept of curve fitting to fit curves to data and analyze the data using measures of central tendencies, correlation and regression.
5	Utilize linear algebraic concepts to solve systems of linear equations and become familiar with the diagonalization of matrices.

**Contents**

**Part-A**

**Unit 1. Applications of Derivatives** **5(L) hrs**

Mean Value Theorem and their geometrical interpretation, Cartesian graphing with first and second-order derivatives, Asymptotes and Dominant terms, Polar coordinates, graphing in Polar coordinates.

**Unit 2. Multiple Integrals and its Applications** **10(L) hrs**

Double Integral in Cartesian-Coordinates, change the order of integration in double integral, Double Integral in Polar coordinates, changing of variables from Cartesian to polar in double integrals, Applications of Double integral to the area and volume, Triple Integral in Cartesian - Coordinates, spherical polar and cylindrical polar coordinates. Application of triple integral to find volume.

**Unit 3. Probability** **7(L) hrs**

Random variable, Discrete probability Distribution, continuous probability distribution, Expectation, Mean and variance using Expectation, Theoretical distributions: Binomial distribution, Poisson Distribution, Normal distribution, fitting B.D. and P.D. into given data.

## Part-B

### Unit 4. Statistical methods and curve fitting

8(L) hrs

Measures of central tendency: Mean, Median and Mode, Measures of Dispersion: range, mean deviation and standard deviation, Correlation, coefficient of correlation, Lines of regression, Curve fitting: Method of least squares, fitting the straight line and parabola.

### Unit 5. Linear Algebra and its applications

9(L) hrs

Gauss Jordan method to find the inverse of a matrix, reduction to echelon and normal form, rank of a matrix, consistency and solution of linear equations, linear dependence and linear independence of vectors, Linear transformations, eigen values, eigen vectors, Cayley Hamilton theorem (without proof), reduction to diagonal form (diagonalization).

#### Text Books

4. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education (2007), 9<sup>th</sup> Edition.
5. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill, New Delhi (2010), 11<sup>th</sup> Reprint,.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers (2010), 36<sup>th</sup> Edition.

#### Reference Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons (2006), 9<sup>th</sup> Edition.
2. R.K. Jain and S.R.K Iyenger, Advanced Engineering Mathematics, Narosa Publications, New Delhi (2008).
3. T. Veerarajan, Engineering Mathematics for first year, Tata McGraw Hill New Delhi (2008).
4. D. Poole, Linear Algebra: A modern Introduction, Brooks/Cole (2005), 2<sup>nd</sup> Edition.

#### Supplementary NPTEL Course

Sr. No.	Course Name	Instructor	Host Institute	URL
1	Introduction to probability and Statistics	Prof. G. Srinivasan	IIT Madras	<a href="https://nptel.ac.in/courses/111106112">https://nptel.ac.in/courses/111106112</a>
2	Basic Linear Algebra	Prof. Inder Kumar Rana	IIT Bombay	<a href="https://nptel.ac.in/courses/111101115">https://nptel.ac.in/courses/111101115</a>

**Course Code: BSC104**  
**Course Title: Chemistry**

<b>Programme:</b> B.Tech.	<b>L: 3 T: 0 P: 0</b>	<b>Credits:</b> 3
<b>Semester:</b> 1/2	<b>Theory/Practical:</b> Theory	<b>Teaching Hours:</b> 39(L)= 39 hrs
<b>Total Max. Marks:</b> 100	<b>Continuous Assessment (CIA) Marks:</b> 40	<b>End Semester Examination (ESE) Marks:</b> 60
<b>Minimum percentage of Numerical: 25-30</b>		
<b>Duration of End Semester Examination (ESE): 3 hours</b>		
<b>Course Type:</b> Core		

**Prerequisites (if any):** NIL

**Additional Material Allowed in ESE:** Calculator is allowed

**On completion of the course, the student will have the ability to:**

CO#	Course Outcomes
1	Select and use the different treatment methods on waste water for domestic and industrial application.
2	Understand the principle of different analytical techniques and identification of structure of different molecules.
3	Attain essential analytical skills for designing of materials for electrical and electronic application.
4	Use the fundamental of chemistry towards developing new technologies based on novel materials.
5	Identify/Elucidate the chemical composition required for design of high-performance materials.

## Contents

### Part-A

#### Unit-1 Water chemistry:

**9(L) hrs**

Introduction, hardness of water (its units, its types, its determination by EDTA method using normality equation). Softening of water by lime-soda method, ion-exchange method and zeolite method. Boiler feed water: - causes, disadvantages, prevention and removal of -scale and sludge formation, priming, foaming, caustic embrittlement and boiler corrosion. Different steps for water purification to make it fit for drinking: - sedimentation, filtration, flocculation, sterilization (using chlorine, bleaching powder, chloramines, ozone & uv rays). Desalination of brackish water by electro dialysis and reverse osmosis.

#### Unit- 2 Spectroscopic techniques and applications

**10(L) hrs**

UV-Visible spectroscopy:- Instrumentation (flow diagram only of single and double beam spectrophotometer and its working), principle (electronic transitions), auxochrome, chromophore, effect of presence of auxochrome on chromophore, bathochromic shift & hypsochromic shift (explanation by using the concept of auxochrome), hyperchromic shift, hypsochromic shift, applications of UV-VIS spectroscopy (detection of functional group, distinction between conjugated and non-conjugated dienes, detection of unknown concentration, detection of molecular weight, Fluorescence, phosphorescence and isobestic points).

IR spectroscopy: -IR range, fingerprint and functional group region, Instrumentation (flow diagram only of single and double beam spectrophotometer and difference between these), principle (vibrations in diatomic and polyatomic molecules), Hook's law & applications of IR spectroscopy (Peak positions of some common functional groups of organic molecules, detection of conjugation & electronic effect).

Nuclear Magnetic Resonance spectroscopy: -Introduction (magnetic nucleus, precessional frequency, equivalent and non-equivalent protons), principle and instrumentation, discussion of <sup>1</sup>H NMR of simple organic molecules (ethane, ethyl chloride and phenol) & applications of <sup>1</sup>H NMR. (detection of aromaticity, detection of cis and trans isomers, detection of structural isomers and detection of

electronegative atom).

## Part-B

### Unit-3 Electrochemistry:

10(L) hrs

Fundamentals of electrochemistry: - electrode, electrode potential, electrochemical series, electrochemical cell, its representation. Nernst equation and applications, numerical based on Nernst equation. Different type of electrodes: - gas, calomel, quinhydrone electrode. Fuel cell. Solar cell. Li ion battery and EV battery.

### Unit-4 Important engineering materials:

10(L) hrs

Polymers: - Introduction (nomenclature, functionality, type of polymerization: addition, condensation and copolymerization). Type of polymers: -thermoplastic resins (cellulosederivatives only), thermosetting resins (detail of phenolic Resin), inorganic(one example each of polyphosphazines, sulphur based polymer & silicones.) & conducting polymer. Effect of the polymer structure on its properties. Effect of heat on the polymers. The mechanical properties of polymer. Polymer blends and alloys. Engineering plastics. Nanomaterials- fullerenes and inorganic nanoparticles. Fullerenes: -Introduction, hydrated fullerenes, fullerite, type of fullerene (buckyball, nanotubes and graphene), application of fullerenes. Nanoparticles – Introduction and properties. Optical materials (OLED).

### Text Books

1. PC Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publication, 14<sup>th</sup> Edition, 2002.
2. B R Puri, LR Sharma and MD Pathania, "Principles of Physical Chemistry, Vishal Publishing Co., 46<sup>th</sup> edition, 2013.
3. Dhiraj Sud, "Comprehensive Engineering Chemistry", Kataria Publishers, 2000.
4. Dhiraj Sud, "Applied Chemistry", Kataria Publishers, 1999.

### Reference Books

1. G. Odian, "Principle of Polymerization", John Wiley & Sons, Inc. 4th Edition
2. J. D. Lee, "Concise Inorganic Chemistry", Chapman & Hall, 5th Edition, 2003
3. P. Atkins and J. de Paula., "Atkin's Physical Chemistry", Oxford University Press, 10<sup>th</sup> Edition, 2014.

### Online Learning Materials

1. B. L. Tembe, Kamaluddin and M. S. Krishnan, "Engineering Chemistry (NPTEL Web-book).
2. NPTEL web lectures: Chemistry of Materials, Engineering Chemistry I & III.
3. <https://nptel.ac.in/courses/104101130>
4. <https://nptel.ac.in/courses/104103019>
5. <https://www.youtube.com/watch?v=8SVHLzs35II&list=PL0KRvN5Kp6y99cNss5fakomw7rrgdVg1k&index=4>
6. <https://www.youtube.com/watch?v=pxC6F7bK8CU>
7. <https://www.youtube.com/watch?v=WjsCFPrQzkU>
8. [https://www.youtube.com/watch?v=k\\_vR0Eqb5gY](https://www.youtube.com/watch?v=k_vR0Eqb5gY)

### Supplementary SWAYAM Course

Sr. No.	Course Name	Instructor	Host Institute	URL

1	Concepts of chemistry for engineering	Prof. Anindya Datta, Prof. Debabrata Maiti, Prof. Chidambar Kulkarni and Prof. Arnab Dutta	IIT Bombay	<a href="https://www.youtube.com/watch?v=f1wu56aLkEQ">https://www.youtube.com/watch?v=f1wu56aLkEQ</a>
2	Elementary Electrochemistry	Prof. Angshuman Roy Choudhury	IISER Mohali	<a href="https://nptel.ac.in/courses/104106137">https://nptel.ac.in/courses/104106137</a>

**Course Code: LBSC104**  
**Course Title: Chemistry Lab.**

<b>Programme:</b> B.Tech.	<b>L: 0 T: 0 P: 2</b>	<b>Credits: 1</b>
<b>Semester:</b> 1/2	<b>Theory/Practical:</b> Practical	<b>Teaching Hours:</b> 26 Hours
<b>Total Max. Marks:</b> 50	<b>Continuous Internal Assessment (CIA) Marks:</b> 30	<b>End Semester Examination (ESE) Marks:</b> 20
<b>Duration of End Semester Examination (ESE):</b> 3 hrs		
<b>Course Type:</b> Core		

**Prerequisites (if any):** NIL

**On completion of the course, the student will have the ability to:**

<b>CO#</b>	<b>Course Outcomes</b>
1	Understand Laboratory Safety and Proper Handling of Glassware.
2	Attain analytical skills for electrical and electronics applications.
3	Apply the fundamentals of chemistry for the benefits of the industrial and societal needs.
4	Understand and maintain the optimum conditions during synthesis of simple molecules.
5	Use of software as important tool in designing of molecules for technological application.

**Contents**

**Choice of 8 experiments from the following. Topic no 1 and 2 are compulsory.**

<b>Experiment No.</b>	<b>Experiment Title</b>
1	Introduction to glass apparatus in chemistry laboratory, its handling, use, cleaning and precautions to be taken in laboratory
2	A demo experiment to explain the solar cell, Li ion battery and EV battery.
3	Determination of total hardness in water.
4	Determination of chloride content in water.
5	Determination of alkalinity in water.
6	Preparation of a polymer.
7	Determination of absolute and relative viscosity of lubricant.
8	Determination of conc. of solution conductometrically.

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9	Determination of conc. of solution pH metrically.
10	Determination of wavelength absorbed and unknown concentration of solution.
11	Determination of Surface Tension of a Liquid using Stalagmometer.
12	Application of open source software in chemistry.

### Reference Books

1. P C Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publication, 14<sup>th</sup> Edition, 2002.
2. S Rattan, "Experiments in Applied Chemistry", S K Kataria & Sons, 1<sup>st</sup> Edition, 2002.
3. Dhiraj Sud, "Comprehensive Engineering Chemistry", Kataria Publishers, 2000.
4. Dhiraj Sud, "Applied Chemistry", Kataria Publishers, 1999.
5. Shashi Chawla, "Theory and Practicals of engineering Chemistry", Dhanpat Rai & Co. 2006.
6. BS Furniss, "Vogel's Textbook of Practical Organic Chemistry", Pearson Education, 5<sup>th</sup> Edition, 2006.

### Online Learning Materials

1. [https://www.youtube.com/watch?v=d75GP5M5Tb8&list=PLAOKTXws9mMBuJLbInoUh98e9m\\_wGTK7F](https://www.youtube.com/watch?v=d75GP5M5Tb8&list=PLAOKTXws9mMBuJLbInoUh98e9m_wGTK7F) Accessed on August 15, 2024
2. <https://www.youtube.com/watch?v=6BJImA0M4Jo> Accessed on August 15, 2024
3. <https://www.youtube.com/watch?v=Kg40ze9torw> Accessed on August 15, 2024
4. [https://www.youtube.com/watch?v=E21v6\\_XxWIw](https://www.youtube.com/watch?v=E21v6_XxWIw) Accessed on August 15, 2024
5. <https://www.youtube.com/watch?v=7ANZLU9rsfM> Accessed on August 15, 2024
- 6.

### Experiments to be performed through Virtual Labs

Sr. No.	Experiment Name	Experiment Link(s)
1	Determination of hardness of water.	<a href="https://vlab.amrita.edu/index.php?sub=2&amp;brch=193&amp;sim=1548&amp;cnt=1">https://vlab.amrita.edu/index.php?sub=2&amp;brch=193&amp;sim=1548&amp;cnt=1</a>



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2	Determination of alkalinity of water.	<a href="https://vlab.amrita.edu/index.php?sub=2&amp;brch=193&amp;sim=1548&amp;cnt=1">https://vlab.amrita.edu/index.php?sub=2&amp;brch=193&amp;sim=1548&amp;cnt=1</a>
3	Determination of wavelength absorbed and unknown concentration of solution	<a href="https://vlab.amrita.edu/index.php?sub=2&amp;brch=190&amp;sim=338&amp;cnt=4">https://vlab.amrita.edu/index.php?sub=2&amp;brch=190&amp;sim=338&amp;cnt=4</a>
4	Application of open source software in chemistry.	<a href="https://www.youtube.com/watch?v=d75GP5M5Tb8&amp;list=PLAOKTXws9mMBuJLbInoUh98e9m_wGTK7F">https://www.youtube.com/watch?v=d75GP5M5Tb8&amp;list=PLAOKTXws9mMBuJLbInoUh98e9m_wGTK7F</a>

GNDDEC

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## SYLLABUS

Course Code: HSMC1012  
Course Title: Professional English Communication

<b>Programme:</b> B.Tech.	<b>L: 3 T: 0 P: 0</b>	<b>Credits: 3</b>
<b>Semester:</b> 1/2	<b>Theory/Practical:</b> Theory	<b>Teaching Hours:</b> 39(L) +0(T) = 39 hrs.
<b>Total Max. Marks:</b> 100	<b>Continuous Assessment (CIA) Marks:</b> 40	<b>End Semester Examination (ESE) Marks:</b> 60
<b>Minimum percentage of Numerical / Design / Programming Problems:</b> NIL		
<b>Duration of End Semester Examination (ESE):</b> 3 hours		
<b>Course Type:</b> Humanities & Social Sciences		

**Prerequisites (if any):** NIL

**On completion of the course, the student will have the ability to:**

CO	Course Outcomes
1	Listen, comprehend and correspond effectively in various communicative contexts
2	Speak clearly and fluently with proper kinesics and voice dynamics under various academic and professional settings by applying principles of effective communication
3	Analyse and evaluate variety of written texts by focusing on different dimensions of meaning and language
4	Apply clear and effective writing skills in variety of styles in coherent manner
5	Utilising appropriate vocabulary and grammatical competence for effective communication
6	Grasp the concept of Organisational communication and compose certain business documents including employment seeking documents in precise and efficient manner.

### Contents

#### Part-A

#### Unit-1 Principles of Communication

9(L) hrs.

Importance of communication; Importance of communication in English; Concept of effective Communication; Assertive communication; Communication and self-concept; Role of emotions in communication; Process of communication; Knowing the purpose and audience. Types of Communication: formal and Informal Communication; verbal and non- verbal; interpersonal communication, intrapersonal communication; Cross cultural communication. Organisational

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Communication: Formal Channels of communication: upward communication, downward communication, horizontal communication and diagonal communication. Informal channel of communication: Grapevine. Barriers to Communication. Tips for effective communication.

**ACTIVITY:** Power point presentations in lab.

### Unit-2 LISTENING SKILLS

**5(L)hrs.**

Listening vs. Hearing; Role of Effective Listening in Communication; Types of Listening; Poor Listening Habits; Active Listening- an effective listening skill; Traits of an Effective Listener; Barriers to Effective Listening.

**ACTIVITY:** Power point presentations in lab.

### Unit-3 KINESICS & VOICE DYNAMICS

**3(L) hrs.**

Kinesics: definition; importance. Features of body language: Personal appearance; Gestures; Postures; Facial expression; Eye contact; Silence; Voice modulation: Quality; Pitch.

**ACTIVITY:** Submission of one-minute video talk in proper tone and body language.

### Part-B

### Unit-4 READING SKILLS

**7(L) hrs.**

Inferring meaning: lexical and contextual meaning. Reading Techniques; Intensive and Extensive reading skills.

**ACTIVITIES:** Reading Comprehension Passages/News article/Essay/short story: Reading for specific points using any kind of resources (Ex. dictionary); Drawing inferences; Understanding denotative and connotative meaning; To reflect how language is being used by writer/Are they persuaded to accept particular view point? / How language is being used to do this?

### Unit-5 GRAMMAR AND BASIC WRITING SKILLS

**9(L) hrs.**

Sentence Structures; Subject-verb Concord; Misplaced Modifiers.

Concept of Technical Writing; 7 C's of effective technical writing: Topic sentence; Creating unity and coherence. Argumentative essay; Writing an email; Business letter writing: Complaint letter, Collection Letter, Inquiry Letter; Preparing Cover letter and Resume.

**ACTIVITIES:** Exercises on Tenses: Sentence Completion/Correction of sentences.

### Unit-6 VOCABULARY SKILLS

**6(L) hrs.**

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## SYLLABUS

1. Idioms and phrases
2. One word substitutes
3. Antonyms & Synonyms
4. Homophone and homonym

### Text Books

7. Meenakshi Raman & Sangeeta Sharma, Technical Communication – Principles and Practices Oxford Univ. Press, 2007, New Delhi.
8. M. Ashraf Rizvi, “*Effective Technical Communication*” McGraw Hill
9. Nitin Bhatnagar & Mamta Bhatnagar. “Communicative English for Engineers and Professionals.” Pearson Education.

### Reference Books

1. “*Fundamentals of Technical Communication*” J.Meenakshi Raman & Sangeeta Sharma Oxford university Press.
2. “*Effective business Communication*” Asha Kaul, Prentice Hall of India.
3. “*Communication Skills For Engineers*” Sunita Mishra & C. Mualikrishna Pearson Education.
4. “*Practical English Usage*.” Michael Swan.OUP.1995
5. “*Remedial English Grammar*” F.T. Wood,Macmillan.2007
6. “*On Writing Well*” William Zinsser. Harper Resource Book.2001
7. “*Communication Skills*.” Sanjay Kumar and Pushpa Lata.Oxford University Press.2011
8. “*Essential English Grammar and Speaking & Writing Skills*” Honey Walia.Ahim Paul Publishers.

#### Online Learning Materials

4. <https://learnenglishteens.britishcouncil.org/vocabulary/> Accessed on July 21, 2024
5. <https://learnenglishteens.britishcouncil.org/grammar> Accessed on July 21, 2024
6. <https://learnenglishteens.britishcouncil.org/skills> Accessed on July 21, 2024
7. <https://www.englisch-hilfen.de/en/> Accessed on July 21, 2024
8. <https://www.english-grammar.at/> Accessed on July 21, 2024

### Supplementary SWAYAM Course

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## SYLLABUS

Sr. No.	Course Name	Instructor	Host Institute	URL
1	Technical English for Engineers	Prof. Aysha Viswamohan	IIT Madras	<a href="https://onlinecourses.nptel.ac.in/noc24_hs175/preview">https://onlinecourses.nptel.ac.in/noc24_hs175/preview</a>

GNDDEC

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## SYLLABUS

Course Code: LHSMC101

Course Title: Professional English Communication Laboratory

Programme: B.Tech.	L: 0 T: 0 P: 2	Credits: 1
Semester: x	Theory/Practical: Practical	Teaching Hours: 26 Hours
Total Max. Marks: 50	Continuous Internal Assessment (CIA) Marks: 30	End Semester Examination (ESE) Marks: 20
Duration of End Semester Examination (ESE): 3 hrs		
Course Type: Humanities & Social Sciences		

Prerequisites (if any): NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Present a structured public talk.
2	Carry out effective interpersonal communication in proper accent, intonation and rhythm.
3	Acquire proficiency in various micro skills involved in effective participation in group discussion
4	Perform satisfactorily in job interviews for achieving career goals
5	Listen, analyse and discuss a spoken text accurately.
6	Articulate and pronounce English words and sentences fluently and clearly in standard acceptable accent

### Contents

Experiment No.	Experiment Title
1	<b><u>LISTENING COMPREHENSION</u></b> -Listening to a recorded talk/interview and participation in peer conversation.
2	<b><u>CONVERSATION AND DIALOGUES.</u></b> Listening to Conversation (formal and informal) such as making statements, asking questions, giving commands, expressing opinions etc. Learning how to engage in everyday conversation/Developing situational awareness/

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	Adapting language use /tone of voice to different situations during dialogue presentation.
3	<b><u>ORAL PRESENTATION:</u></b> The students will deliver power point presentations.
4	<b><u>GROUP DISCUSSION:</u></b> The students will be demonstrated various micro skills involved in group discussion and they will be engaged in mock group discussion sessions.
5	<b><u>JOB INTERVIEW:</u></b> The students will be demonstrated the skill of appearing for selection interview and they will be engaged in mock interview sessions
6	<b><u>SPEAKING SKILLS:</u></b> Pronunciation; Articulation; Word stress. International Phonetic Alphabet (IPA) Symbols: Vowels & Consonants; Rules of Pronunciation.

**Mini Project:** (Group Activity) Preparing a 5- minute video documentary along with narration in proper accent on any social evil/societal concern etc. and making a presentation in the lab.

### Reference Books

1. R.K. Bansal & J.B. Harrison “ Spoken English”. Orient Longman
2. J.Sethi, Kamlesh Sadanand & D. V. Jindal, “A Practical Course in English Pronunciation” .. Prentice Hall of India Pvt. Ltd. New Delhi.
3. T. Balasubramaniam, A Text book of English Phonetics for Indian Students” Macmillan.
4. Daniel Jones, “English Pronouncing Dictionary” Current Edition with CD  
Rosetta Stone English Library
5. Murphy’s English Grammar with CD. Cambridge
6. Meenakshi Raman & Sangeeta Sharma, Technical Communication – Principles and Practices.  
Oxford Univ. Press, 2007, New Delhi.
7. M. Ashraf Rizvi” Effective Technical Communication” Tata McGraw Hills.

### Online Learning Materials

1. <https://lingua.com/english/listening/> Accessed on July 21, 2024
2. <https://lingua.com/english/grammar/> Accessed on July 21, 2024
3. <https://learnenglishteens.britishcouncil.org/skills> Accessed on July 21, 2024
4. <https://www.englisch-hilfen.de/en/> Accessed on July 21, 2024

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## SYLLABUS

**Course Code: HSMC102**

**Course Title: Economics**

<b>Programme:</b> B.Tech.	<b>L: 2 T: 1 P: 0</b>	<b>Credits:</b> 3
<b>Semester:</b> x	<b>Theory/Practical:</b> Theory	<b>Teaching Hours:</b> 28(L)+14(T)= 42 hrs
<b>Total Max. Marks:</b> 100	<b>Continuous Assessment (CIA) Marks:</b> 40	<b>End Semester Examination (ESE) Marks:</b> 60
<b>Minimum percentage of Numerical / Design / Programming Problems:</b> 40		
<b>Duration of End Semester Examination (ESE):</b> 3 hours		
<b>Course Type:</b> Core/Professional Elective/Open Elective Course		

**Prerequisites (if any):** NIL

**Additional Material Allowed in ESE:** Scientific Calculators are allowed

**On completion of the course, the student will have the ability to:**

CO#	Course Outcomes
1	Understand basic economic principles.
2	Understand consumer behavior analysis.
3	Evaluate cost of various factors of production.
4	Compare different market structures.
5	Analyzing basic concepts of Macroeconomics.
6	Understanding National Income and Inflation

### Contents

#### Part-A

#### Unit-1 Introduction to Economics

4(L)+1(T)

Why study Economics? Scope of Economics; Types of Economics; Concepts of Economics: Wealth, Welfare and Scarcity; Economic Problem: Scarcity and Choice; Concept of Opportunity Cost; The Question of What to Produce, How to produce and for Whom to Produce; Economic Activities: Consumption, Production, Exchange, Distribution and Public Finance; Relationship of Economics with



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## **SYLLABUS**

other Social Sciences and Engineering; Non-Economic Activities

### **Unit-2 Theory of Consumer Behaviour**

**6(L)+3(T)**

Demand-Types of Demand; Determinants of Demand; Change in Demand: Movement and Shift of Demand; How to Estimate Demand? Law of Demand, Elasticity of Demand and its Application in Present Scenario. Utility Analysis; Assumptions; Consumption Decision: Budget Constraint; Changes in Consumption Pattern; Laws of Consumption: Concept and Applicability of Law of Diminishing Marginal Utility and Law of Equi-Marginal Utility

### **Unit-3 Cost and Production Analysis**

**6(L)+3(T)**

Cost Concept; Production and Cost; Cost in the Short and Long Run; Short Run Cost and Output Decision; Cost and Output in the Long Run. Relationship between TC, AC and MC. Production: Scale of Production, Short Run Production Function; Long Run Production Function; Stages, Significance and Practical Application of Law of Variable Proportion and Law of Return to scale. Economies and Diseconomies of Scale: Concept and Types. Relevance of Production and Cost Concept in Real Situation.

### **Unit-4 Market Structure**

**3(L)+1(T)**

Perfect Competition, Monopoly, Oligopoly and Monopolistic Competition; Comparison Between Different Forms of Market Structure with Real Life Examples; Government Policies towards Different Forms; Nature and Relevance of different Markets in Present Scenario.

## **Part-B**

### **Unit-5 Basic Macroeconomic Concepts**

**3(L)+2(T)**

Importance of studying Macroeconomics; Interest Rates Determination; Sources of Interest Rate Differentials; Unemployment and Full Employment; Profit Concept: Functions of Profit; Economic Profit and Accounting Profit

### **Unit-6 National Income, Inflation & Taxes**

**3(L)+2(T)**

National Income Concepts; GDP, GNP, NNP; Measurement of National Income: Income, Expenditure and Value Added Methods; Types of Inflation; Role of Inflation in Economic Development; Introduction to Taxes and its Types

### **Unit-7 Economic Policies**

**3(L)+2(T)**

Monetary and Fiscal Policy; Instruments of Monetary and Fiscal Policy; Role of Monetary and Fiscal Policy in a Developing Country; Money: Functions; Determination of Money supply.

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*Tutorial hours will be used for practice sessions for design/numerical problems/programming/case-studies etc.*

### Text Books

10. "Principles of Microeconomics", Stiglitz J.E. and Walsh C.E., W.W. Norton & Company, 2016
11. "Principles of Macroeconomics", Stiglitz J.E. and Walsh C.E., Pubs: W.W. Norton & Company, 2016

### Reference Books

1. "Managerial Economics: Foundations of Business Analysis and Strategy", Thomas and Mauris, McGraw Hill, 2017
2. "Principles of Economics", Greenlaw S.A., Shapiro D., Taylor T., Pubs: OpenStax, 2017
3. Macroeconomics: Understanding the wealth of Nations, David Miles and Andrew Scott published by John Wiley and Sons, 2002
4. Intermediate Microeconomics: A Modern Approach, Hal R. Varian, 2010

### Online Learning Materials

1. <https://egyankosh.ac.in/bitstream/123456789/53988/1/Block-2.pdf> Accessed on 19<sup>th</sup> August, 2024
2. <https://ncert.nic.in/textbook/pdf/leec202.pdf> Accessed on 19<sup>th</sup> August, 2024
3. <https://math.hawaii.edu/~mchyba/documents/syllabus/Math499/extracredit.pdf> Accessed on 19<sup>th</sup> August, 2024
4. <https://www.vedantu.com/commerce/national-income-accounting> Accessed on 19<sup>th</sup> August, 2024
5. <https://blog.ipleaders.in/taxation-and-its-effect-on-inflation/> Accessed on 19<sup>th</sup> August, 2024

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## SYLLABUS

**Course Code:** ESC101

**Course Title:** Basic Electrical and Electronics Engineering

<b>Programme:</b> B.Tech.	<b>L: 3 T: 1 P: 0</b>	<b>Credits:</b> 4
<b>Semester:</b> 1 <sup>st</sup> / 2 <sup>nd</sup>	<b>Theory/Practical:</b> Theory	<b>Teaching Hours:</b> 39(L)+13(T)= 52 hrs
<b>Total Max. Marks:</b> 100	<b>Continuous Assessment (CIA) Marks:</b> 40	<b>End Semester Examination (ESE) Marks:</b> 60
<b>Minimum percentage of Numerical / Design / Programming Problems:</b> 30%		
<b>Duration of End Semester Examination (ESE):</b> 3 hours		
<b>Course Type:</b> Core		

**Prerequisites (if any):** NIL

**Additional Material Allowed in ESE:** Scientific calculator

**On completion of the course, the student will have the ability to:**

CO#	Course Outcomes
1	Understand basic concepts of Electrical and Electronics Engineering.
2	Apply circuit analysis techniques to solve problems related to DC circuits and networks.
3	Apply knowledge of magnetic circuits to select electrical machines required for a particular application.
4	Comprehend the basic mechanism of semiconductors in diodes and transistors.
5	Analyze the behavior of different electronic components in terms of V-I characteristics.
6	Apply the knowledge of number systems and binary operations to analyze and design digital circuits.

### Contents

#### Part-A

#### Unit-1 DC Circuits

**5 (L) hrs**

Circuit elements and connected terminology, Kirchhoff's Laws- Statement and Illustrations, Method of solving circuits by Kirchhoff's law, Star-Delta Conversion, Ohm's Law- Statement, Illustration and Limitation, Units- Work, Power and Energy (Electrical, Thermal and Mechanical).

#### Unit-2 AC Fundamentals

**6 (L) hrs**

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Principle of AC Voltage waveforms and basic definitions, Peak, Root Mean Square and Average value of alternating current, Phasor representation of alternating quantities. Ohm's Law in AC circuits, Resistive, Inductive & Capacitive circuits, and their series and parallel combinations. Concept of resonance in series and parallel circuits, Analysis of balanced Three-phase system with star-delta connections.

### Unit-3 Magnetic Circuits and Electrical Machines

8 (L) hrs

Comparison between magnetic and electric circuits, Magnetic effects of electric current, Current carrying conductor in magnetic field, Law of Electromagnetic Induction, Self-Inductance, Mutual Inductance, Coupling Coefficient between two magnetically coupled circuits. Construction, Working principle, Classification and Applications of: Single-phase Transformer, D.C. machines (motor and generator), Three-phase Induction motor, and Three-phase Synchronous machines (motor and generator).

## Part-B

### Unit-4 Digital Electronics

6 (L) hrs

Number Systems: Binary, Decimal, Octal, Hexadecimal and their conversions, Logic gates:symbol and truth table - AND, OR, NOT, EX-OR, EX-NOR, Universal gates: NOR, NAND, Binary addition, Binary subtraction, 1's complement, 2's complement, Applications of logicgates: Half adder, full adder.

### Unit-5 Semiconductor Diodes

6 (L) hrs

Semiconductors: Intrinsic and Extrinsic, PN junction diode: working and V-I characteristics, Diode applications, Special Diodes: Light Emitting Diode as a circuit element, Photodiode, Zener diode as voltage regulator.

### Unit-6 Transistors

8 (L) hrs

Transistors: Introduction, construction, working and characteristics, npn and pnp transistors, Basic configurations: common emitter, common base, common collector, Transistor as an amplifier and switch, Operational amplifier: schematic symbol, block diagram, Ideal op-amp and ideal voltage transfer curve.

*Tutorial hours will be used for practice sessions for design/numerical problems/programming/case-studies etc.*

### Text Books

1. B.L. Theraja and A.K Theraja, "A Textbook of Electrical Technology", 23<sup>rd</sup> Edition, S Chand, 1959.

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## SYLLABUS

2. Vincent Del Toro, “Electrical Engineering Fundamentals”, 2<sup>nd</sup> Edition, Prentice Hall, 2015.
3. D. P. Kothari and I J Nagrath, “Basic Electrical Engineering”, 4<sup>th</sup> Edition, Mc Graw Hill, 2019.
4. C. L. Wadhwa, “Basic Electrical Engineering”, Fifth Edition, New Age International Publishers, 2023
5. Robert L. Boylestad, “Introductory Circuit Analysis”, 13<sup>th</sup> Edition, Pearson, 2015.
6. R. P. Jain, Modern Digital Electronics, 4<sup>th</sup> Edition, Tata McGraw–Hill, 2009.
7. R. L. Boylestad and L. Nashelsky, “Electronic Devices and Circuits Theory”, 9<sup>th</sup> Edition, Prentice Hall, 2006.
8. R. P. Jain and K. Sarawadekar, “Modern Digital Electronics”, 5<sup>th</sup> Edition, McGraw–Hill, 2022.

### Reference Books

9. A. Malvino, D. J. Bates, “Electronic Principles”, 7<sup>th</sup> Edition, McGraw Hill Education, 2017.
10. J. Millman, C., C. Halkias and S. Jit, “Electronic Devices and Circuits”, 4<sup>th</sup> Edition, McGraw Hill Education, 2015.

### Online Learning Materials

1. [https://www.youtube.com/watch?v=J4oO7PT\\_nzQ](https://www.youtube.com/watch?v=J4oO7PT_nzQ) Accessed on July 08, 2024
2. <https://www.youtube.com/watch?v=INeYZqtjTo> Accessed on July 08, 2024
3. <https://www.youtube.com/watch?v=WKHky89QaV0> Accessed on July 08, 2024

### Supplementary SWAYAM Course

Sr. No.	Course Name	Instructor	Host Institute	URL
1	Basic Electrical Circuits	Prof. Gajendranath Chowdary	IIT Madras	<a href="https://www.nptel.ac.in/courses/106101001/">Basic Electrical Circuits - Course (nptel.ac.in)</a>
2	A Basic Course on Electric and Magnetic Circuits	Prof. Ashok Kumar Pradhan	IIT Kharagpur	<a href="https://www.nptel.ac.in/courses/106101001/">A Basic Course on Electric and Magnetic Circuits - Course (nptel.ac.in)</a>

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Course Code: LESC101

Course Title: Basic Electrical and Electronics Engineering Laboratory

<b>Programme:</b> B.Tech.	<b>L: 0 T: 0 P: 2</b>	<b>Credits: 1</b>
<b>Semester:</b> 1 <sup>st</sup> /2 <sup>nd</sup>	<b>Theory/Practical:</b> Practical	<b>Teaching Hours:</b> 26 Hours
<b>Total Max. Marks:</b> 50	<b>Continuous Internal Assessment (CIA) Marks:</b> 30	<b>End Semester Examination (ESE) Marks:</b> 20
<b>Duration of End Semester Examination (ESE):</b> 3 hrs		
<b>Course Type:</b> Core Course		

**Prerequisites (if any):** NIL

**On completion of the course, the student will have the ability to:**

CO#	Course Outcomes
1	Demonstrate knowledge of safety standards governing electrical engineering practices.
2	Recognize different electrical components like resistances, inductances, capacitances, and their behavior.
3	Verify and interpret basic laws of electric circuits like Ohm's Law and Kirchhoff's Law
4	Demonstrate the behavior of diodes, transistors and op-amp and also analyze their characteristics.
5	Verify the truth tables of various logic gates.
6	Design electrical and electronic circuits by utilizing various components.

### Contents

Experiment No.	Experiment Title
1	To verify Ohm's Law.
2	To verify Kirchhoff's Current Law and Kirchhoff's Voltage Law.
3	To verify series and parallel resonance in AC circuit.
4	To connect, start and reverse the direction of rotation of a 3- phase induction motor.
5	To find out the line voltage, phase voltage relationship, line current and phase current relationship in case of star and delta connected 3- phase balanced load.
6	To study the use of a multimeter.
7	To find a voltage-current relationship in an R-L, R-C, and R-L-C series circuit and to

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	determine the power factor of the circuit.
8	To examine the I-V characteristics of a PN junction diode.
9	To obtain the input and output characteristics of NPN and PNP transistors.
10	To measure and compare the output waveforms of half-wave and center-tap full-wave rectifier.
11	To design and analyze an AC to DC power supply using rectifier and capacitive filter.
12	To measure the output of an op-amp in the inverting and non-inverting configuration.
13	To design and verify the truth tables of logic gates: AND, OR, NOT, NAND, NOR.

### Reference Books

5. S.K. Sahdev, "Basic Electrical Engineering (with Lab Manual)" First Edition, Khanna publication, 2022.
6. Laboratory Manuals.

### Online Learning Materials

16. [https://www.youtube.com/watch?v=fdqnYttEzPU&list=PLTntHiTOym6Cp7sufUtj\\_4CUJ9ALWudh](https://www.youtube.com/watch?v=fdqnYttEzPU&list=PLTntHiTOym6Cp7sufUtj_4CUJ9ALWudh)
17. [https://www.youtube.com/watch?v=JRTKTFmiQo&list=PL2Q\\_0aXptw11foD9eKFGXo3iQfOriDmp5](https://www.youtube.com/watch?v=JRTKTFmiQo&list=PL2Q_0aXptw11foD9eKFGXo3iQfOriDmp5)

### Experiments to be performed through Virtual Labs

Sr. No.	Experiment Name	Experiment Link(s)
1	To verify Ohm's Law.	<a href="https://be-iitkgp.vlabs.ac.in/exp/ohm-law/">https://be-iitkgp.vlabs.ac.in/exp/ohm-law/</a>
2	Extraction of diode SPICE parameters related to forward Current-Voltage (I-V) characteristics	<a href="https://be-iitkgp.vlabs.ac.in/exp/characteristics-diode/">https://be-iitkgp.vlabs.ac.in/exp/characteristics-diode/</a>
3	To measure and compare the output waveforms of half-wave and center-tap full-wave rectifier.	<a href="https://be-iitkgp.vlabs.ac.in/exp/half-wave-rectification/">https://be-iitkgp.vlabs.ac.in/exp/half-wave-rectification/</a> <a href="https://be-iitkgp.vlabs.ac.in/exp/full-wave-rectification/">https://be-iitkgp.vlabs.ac.in/exp/full-wave-rectification/</a>
4	To measure the output of an op-amp in the inverting and non-inverting configuration.	<a href="https://be-iitkgp.vlabs.ac.in/exp/non-inverting-amplifiers/">https://be-iitkgp.vlabs.ac.in/exp/non-inverting-amplifiers/</a>

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## SYLLABUS

Course Code: ESC102

Course Title: Engineering Drawing and Graphics

Programme: B.Tech.	L: 1 T: 0 P: 4	Credits: 3
Semester: 1 <sup>st</sup> /2 <sup>nd</sup>	Theory/Practical: Theory	Teaching Hours: L(13)+P(52)=65 Hrs
Total Max. Marks: 100	Continuous Assessment (CIA) Marks: 40	End Semester Examination (ESE) Marks: 60
Minimum percentage of Numerical / Design / Programming Problems: NIL		
Duration of End Semester Examination (ESE): 3 hours		
Course Type: Core		

Prerequisites (if any): NIL

### NOTE:

*End semester examination paper setting will be from the first four units only.*

*Unit V and VI will be the part of internal evaluation only carrying 20% weightage.*

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Understand various terms used in engineering drawing.
2	Interpret the drawing in terms of engineering requirements.
3	Apply rules and conventions as per international standards for engineering drawing.
4	Learn and apply orthographic as well as isometric projections as per engineering requirements.
5	Understand the concept of computer graphics and related aspects.
6	Use CAD software to draw 2D and 3D models by using different types of commands.

### Contents

#### PART: A

#### Unit I: Introduction to Engineering Drawing

(2L+8P=10 hrs)

Principles of Engineering Graphics and their significance as per international/national standards SP46:2003 and IS 962-1989, usage of Drawing instruments, conventional



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representation, lettering; Scales – Plain and Diagonal scales

### **Unit II: Orthographic Projections**

**(4L+12P=16 hrs)**

Principles of Orthographic Projections, Projections of Points, Projection of lines, plane and solid covering inclined/perpendicular/parallel to one plane

### **Unit III: Sections and Sectional Views of Right Regular Solids**

**(3L+12P=15 hrs)**

Prism, Cylinder, Pyramid, Cone – Draw the sectional views of geometrical solids, Development of surfaces of Right Regular Solids- Prism, Pyramid, Cylinder and Cone

### **Unit IV: Isometric Projections**

**(2L+8P=10 hrs)**

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

#### **PART:B**

### **Unit V: Overview of Computer Graphics and Customization of CAD Drawing** **(1L+6P=7hrs)**

Demonstrating knowledge of the theory of CAD software such as: The Menu System, Toolbars, Drawing Area, Dialog boxes and windows, The Command Line, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles

### **Unit VI: Annotations, layering & other functions**

**(1L+6P=7hrs)**

Apply dimensions to objects, apply annotations to drawings; Setting up and use of Layers,

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layers to create drawings, Create, edit and use customized layers; orthographic projection techniques; Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids, Parametric and non-parametric solid,surface, and wireframe models

### Text Books

1. Jain, Maheshwari, Gautam , “Engineering Graphics & Design”, Khanna Book Publishing, 2021.
2. Bhatt N.D., Panchal V.M. & Ingle P.R., “Engineering Drawing”, Charotar Publishing, 2014.
3. Shah, M.B. & Rana B.C., “Engineering Drawing and Computer Graphics”, Pearson, 2008.
4. Agrawal B. & Agrawal C. M., “Engineering Graphics”, TMH Publication, 2012.
5. Narayana, K.L. & P Kannaiah , “Text book on Engineering Drawing”, Scitech Publishers, 2008.
6. (Corresponding set of) CAD Software Theory and User Manuals.

### Reference Books

11. Johle A Dhananjay, “Engineering drawing with an introduction to Auto CAD”, Tata McGraw Hill Publishing Ltd., 2008.
12. Jeyapoovan T., “Engineering Graphics using Auto CAD 2000”, Vikas Publishing Pvt. Ltd., 2003.
13. Gill P.S., “Engineering Drawing”, Katson Publication, 2016.
14. Singh Harwinder, “Engineering Drawing and Computer Graphics”, Dhanpat Rai Publishing Company, 2023

### Alternative NPTEL/SWAYAM Course:

Sr. No.	Course Name	Instructor	Host Institute
1	Engineering Drawing and Computer Graphics	Prof. RajaramLakkaraju	IIT Kharagpur
2	Engineering Graphics	Prof. Nihar RanjanPatra	IIT Khanpur

Course Code: ESC-102

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## SYLLABUS

Course Code: ESC103

Course Title: Programming for Problem Solving

<b>Programme:</b> B.Tech.	<b>L: 2 T: 0 P: 2</b>	<b>Credits: 3</b>
<b>Semester:</b> 1	<b>Theory/Practical:</b> Theory + Practical	<b>Teaching Hours:</b> 52 hrs
<b>Total Max. Marks:</b> 150	<b>Continuous Assessment (CIA) Marks:</b> 90	<b>End Semester Examination (ESE) Marks:</b> 60
<b>Minimum percentage of Numerical / Design / Programming Problems:</b> 60%		
<b>Duration of End Semester Examination (ESE):</b> 3 hours		
<b>Course Type:</b> Core		

**Prerequisites:** Introductory Course

**Additional Material Allowed in ESE:** None

**On completion of the course, the student will have the ability to:**

CO#	Course Outcomes
1	Design simple algorithms and flowcharts for problem solving.
2	Demonstrate modular programs involving input output operations, decision making and looping constructs by choosing the appropriate data types for writing programs.
3	Test and execute programs and correct syntax and logical errors.
4	Implement conditional branching, iteration and recursion.
5	Apply the concept of arrays and string handling in problem solving.
6	Use concept of structures and union in problem solving.

### Contents

#### Part-A

#### Unit-1 Introduction to Computer Fundamentals

3(L) + 1(P) hrs

Computer System Components: Input and Output Devices, Memory and Storage Devices, Block diagram of Computer System, Types of Software, Operating System with its types, Compiler, Interpreter, Assembler, Linker, Loader.

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### Unit-2 Basics of Programming

3(L) + 3(P) hrs

Idea of Algorithm: Steps to solve logical and numerical problems. Algorithms, Flowchart, Pseudocode with examples. Basic C++ Program, Compile and Execute C++ program, Character Set, Tokens- Identifiers, Keywords, Variables, Literals, Constants, Data Types, Different types of errors.

### Unit-3 Operators

3(L) + 5(P) hrs

Different types of Operators: Assignment Operators, Numeric operators, Prefix and postfix operators, Binary number system, Bitwise operators, Logical operators, Relational operators, Short-circuit operators, sizeof operator, Operator precedence and associativity. Type conversion.

### Unit-4 Control Structures

4(L) + 4(P) hrs

Conditional Statements: if, if-else, conditional operator (?:), switch and nested decision statements; Looping Statements: for, while, do-while, Nested Loops, and Controlling loop execution keywords: break, continue, goto keyword and labeled statements multiple-selection keywords: switch, case, default keywords

### Part-B

### Unit-5 Functions

5(L) + 5(P) hrs

Functions: Need of functions, Components of Functions, Built-in and User Defined Functions, Parameter passing in function: Call by value, Call by reference, Scope rules, Default Arguments, Function Overloading, Recursion: Base case and recursive case, Recursion versus Iteration.

### Unit-6 Arrays

4(L) + 4(P) hrs

Arrays: Single-Dimensional and Multi-Dimensional arrays, Array operations, Character array and strings literals, string literals declaring, initializing, and using strings basic string operations, comparing strings; Pointers: declaring and initializing pointers.

### Unit-7 Structures and Unions

3(L) + 5(P) hrs

Structures: Need and syntax of structures, Structure Operations- Passing and returning structures from functions, Nested Structures, Array of Structures, typedef, Union, Structure versus Union.

### Laboratory Work

To implement programs in C++ Language for various kinds of problems related to the above topics.

*Theory classes will be scheduled in sub-group manner as theory cum laboratory sessions.*

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### **Text Books**

1. D. Ravichandran, Programming with C++, Tata McGraw-Hill Education
2. Harvey M. Deitel and Paul J. Deitel, C++ How to Program, Pearson Education

### **Reference Books**

1. Herbert Schildt, C++: The Complete Reference, Mc-Graw Hill.
2. E. Balagurusamy, Object Oriented Programming with C++, Mc-Graw Hill.
3. Yashavant Kanetkar, Let Us C++, BPB Publication.

GNDDEC

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## SYLLABUS

Course Code: ESC104

Course Title: Manufacturing Practices

<b>Programme:</b> B.Tech.	<b>L: 0 T: 0 P: 4</b>	<b>Credits:</b> 2
<b>Semester:</b> 1/2	<b>Theory/Practical:</b> Practical	<b>Teaching Hours:</b> 52 Hours
<b>Total Max. Marks:</b> 50	<b>Continuous Internal Assessment (CIA)Marks:</b> 30	<b>End Semester Examination (ESE) Marks:</b> 20
<b>Duration of End Semester Examination (ESE):</b> NIL		
<b>Course Type:</b> Core/Professional Elective/Open Elective Course		

**Prerequisites (if any):** NIL

**On completion of the course, the student will have the ability to:**

CO#	Course Outcomes
1	Make various carpentry utility items with the use of various joints.
2	Practice of various forging, welding, electric, sheet metal tools and equipments.
3	Make mould and cast products of different shapes.
4	Finish various jobs by using finishing tools.
5	Operate different machines and perform different operations.

### Contents

Experiment No.	Experiment Title
1	<b>Carpentry and Pattern Making:</b> Various types of timber, defects in timber, seasoning of wood; tools, wood operations and various joints; exercises involving use of important carpentry tools to practice various operations and making joints.
2	<b>Foundry Shop:</b> Introduction to molding materials; moulds; cores; melting furnaces; tools and equipment used in foundry shops; exercises involving preparation of small sand moulds and castings. Introduction to Plastic Molding.
3	<b>Forging Practice:</b> Introduction to forging tools; equipments and operations; forgability of metals; exercises on simple smithy and forging.
4	<b>Machine Shop:</b> Introduction to various types of Machines; cutting tools and operations; exercises involving machining operations; Introduction to CNC machining and additive manufacturing.
5	<b>Welding Shop:</b> Introduction to different welding methods; sheet metal

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	forming and joining methods; welding equipments; electrodes; welding joints; welding defects; exercises involving use of gas/electric arc welding.
6	<b>Electrical Shop:</b> Introduction to electrical wiring and electrical machines; soldering practice for electrical and electronic applications; Demonstration of various electrical measuring instruments, wiring accessories, modern electrical tools; Introduction to safety devices and earthing; practice on domestic electrical wiring circuits.
7	<b>Fitting Shop:</b> Demonstration of measuring instruments; tools used in fitting shop; exercise involving marking, cutting, fitting practice (Right Angles), matching parts practice, trapping practice.

**Mini Project: The student must fabricate a model of their interest at the end of the course by taking the help of any of the workshops.**

### Reference Books;

1. 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.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4<sup>th</sup> edition, Pearson Education India Edition, 2002.
3. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.
4. Shan H.S., "Manufacturing processes", Cambridge University Press, India; Second edition, 2017.