

Guru Nanak Dev Engineering College, Ludhiana
(An Autonomous College u/s 2 (f) and 12 (B) of UGC Act 1956)
Department of Applied Science
Study Scheme
B.Tech. (Applied Science)
2018 Admission Batch Onwards

First Semester [#]										
Category	Code	Course Title	Subject Type (Theory/ Practical)	Hours Per Week			Marks Distribution		Total Marks	Credits
				L	T	P				
Basic Sciences	BSC-101	Physics	Theory	3	1	0	40	60	100	4
Basic Sciences	BSC-102	Physics Lab	Practical	0	0	2	30	20	50	1
Basic Sciences	BSC-103	Mathematics-I	Theory	3	1	0	40	60	100	4
Humanities and Social Sciences including Management courses	HSMC-103	Principles of Engineering Economics and Management	Theory	2	1	0	40	60	100	3
Engineering Sciences	ESC-101	Basic Electrical Engineering	Theory	3	1	0	40	60	100	4
Engineering Sciences	ESC-102	Basic Electrical Engineering Laboratory	Practical	0	0	2	30	20	50	1
Engineering Sciences	ESC-103 ^{**}	Engineering Graphics and Design	Theory	1	0	4	40	60	100	3
Mandatory Courses	MPD-101 ^{***}	Mentoring and Professional Development	Practical	0	0	1	50	0	50	0
	Total								600	20
Category	Code	Course Title	Subject Type (Theory/ Practical)	Hours Per Week			Marks Distribution		Total Marks	Credits
				L	T	P				
Basic Sciences	BSC-104	Mathematics-II	Theory	3	1	0	40	60	100	4
Basic Sciences	BSC-105	Chemistry	Theory	3	1	0	40	60	100	4
Basic Sciences	BSC-106	Chemistry Lab	Practical	0	0	2	30	20	50	1
Engineering Sciences	ESC-104	Programming for Problem Solving	Theory	3	1	0	40	60	100	4
Engineering Sciences	ESC-105	Programming for Problem Solving Laboratory	Practical	0	0	2	30	20	50	1
Engineering Sciences	ESC-106	Manufacturing Practices	Practical	0	0	4	30	20	50	2
Humanities and Social Sciences including Management courses	HSMC-101	English	Theory	3	0	0	40	60	100	3
Humanities and Social Sciences including Management courses	HSMC-102	English Laboratory	Practical	0	0	2	30	20	50	1
Mandatory Courses	MPD-101 ^{***}	Mentoring and Professional Development	Practical	0	0	1	50	0	50	0
	Total								600	20

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Department of Applied Science
Study Scheme

B.Tech. (Applied Science)
2018 Admission Batch Onwards

Second Semester^{*}**

Category	Code	Course Title	Subject Type (Theory/ Practical)	Hours Per Week			Marks Distribution		Total Marks	Credits
				L	T	P				
Basic Sciences	BSC-104	Mathematics-II	Theory	3	1	0	40	60	100	4
Basic Sciences	BSC-105	Chemistry	Theory	3	1	0	40	60	100	4
Basic Sciences	BSC-106	Chemistry Lab	Practical	0	0	2	30	20	50	1
Engineering Sciences	ESC-104	Programming for Problem Solving	Theory	3	1	0	40	60	100	4
Engineering Sciences	ESC-105	Programming for Problem Solving Laboratory	Practical	0	0	2	30	20	50	1
Engineering Sciences	ESC-106	Manufacturing Practices	Practical	0	0	4	30	20	50	2
Humanities and Social Sciences including Management courses	HSMC-101	English	Theory	3	0	0	40	60	100	3
Humanities and Social Sciences including Management courses	HSMC-102	English Laboratory	Practical	0	0	2	30	20	50	1
Mandatory Courses	MPD-101***	Mentoring and Professional Development	Practical	0	0	1	50	0	50	1
	Total								600	21
Category	Code	Course Title	Subject Type (Theory/ Practical)	Hours Per Week			Marks Distribution		Total Marks	Credits
				L	T	P				
Basic Sciences	BSC-101	Physics	Theory	3	1	0	40	60	100	4
Basic Sciences	BSC-102	Physics Lab	Practical	0	0	2	30	20	50	1
Basic Sciences	BSC-103	Mathematics-I	Theory	3	1	0	40	60	100	4
Humanities and Social Sciences including Management courses	HSMC-103	Principles of Engineering Economics and Management	Theory	2	1	0	40	60	100	3
Engineering Sciences	ESC-101	Basic Electrical Engineering	Theory	3	1	0	40	60	100	4
Engineering Sciences	ESC-102	Basic Electrical Engineering Laboratory	Practical	0	0	2	30	20	50	1
Engineering Sciences	ESC-103**	Engineering Graphics and Design	Theory	1	0	4	40	60	100	3
Mandatory Courses	MPD-101***	Mentoring and Professional Development	Practical	0	0	1	50	0	50	1
	Total								600	21

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#	Mandatory induction programme will start immediately after the commencement of classes of first semester.
##	Evaluation of this subject will be done like other theory subjects.
*	BSC = Basic Science Course; ESC= Engineering Science Course; HSMC =Humanities and Social Sciences including Management courses.
	MPD= Mentoring and professional development (Core branch subject)
**	Group A = Physics Group; Group B = Chemistry Group
***	There will be one period per week for Mentoring and Professional Development; final evaluation of this course will be done based on the combined assessment of odd and even semester of respective year of study.
Physics Group-Math-I, Chemistry Group-Math-II and vice versa next semester.	


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Subject Code: BSC-101

Subject Name: Physics

Programme: B.Tech.	L:3 T:1 P:0
Semester: 1 st / 2 nd	Teaching Hours: 40
Theory/Practical: Theory	Credits: 4
Internal Marks: 40	Percentage of numericals/design/programming problems - 30%
External Marks: 60	Duration of End Semester Exam(ESE): 3hrs
Total Marks: 100	Course Status: Compulsory

Prerequisites: Physics at 10+2 level, Basic knowledge of calculus and trigonometry
Additional Material Allowed in ESE: Scientific Calculator

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

CO #	Course Outcome (CO)
1.	Solve the problems in the fields of electromagnetism, lasers and fiber optics.
2.	Apply the knowledge acquired from the study of semiconductors to identify their use in latest technologies.
3.	Recognize the inadequacy of classical mechanics for certain physical problems and thus find the solutions of these problems using principles of quantum physics.
4.	Comprehend the concept of oscillations and hence to implement the same in the theory of machines.
5.	Understand the basic characteristics of materials relevant to engineering and technological applications.
6.	Apply multidisciplinary knowledge of science for reviewing complex problems from different angles/perspectives and to find the best possible solution/model.

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Page 1 of 3

PAGE ...1... OF ...28...

Detailed Contents:

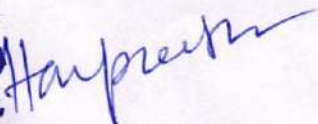
Part-A

- 1. Basics of electromagnetic theory:** Concept of Gradient, Divergence & Curl, Relationship between Electric Field & Potential, Solid angle, Statements of Gauss's and Stoke's theorem, Maxwell's Equations in differential form, EM wave equation in vacuum, Transverse nature and polarization of EM waves, Introduction to Poynting vector. **07 Lectures**
- 2. Laser and Fiber optics:** Spontaneous & Stimulated Emissions, Einstein's theory, Components of laser, Classification of Lasers, Ruby Laser, He-Ne Laser, CO₂ Laser, Semiconductor Laser, Applications of Lasers in science, engineering and medicine, Introduction to fibre optics; Acceptance angle and numerical aperture, Step index and graded index optical fibres, V-number and modes of propagation, Loss in optical fibres (Qualitative idea), splicing, coupling and connectorizing, applications of optical fibres. **09 Lectures**
- 3. Semiconductors:** Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport, diffusion and drift, p-n junction, Introduction to LED and solar cell. **05 Lectures**

Part- B

- 4. Mechanics and mechanics of solids:** Harmonic oscillator, Free, damped and forced oscillators, Impedance matching and resonance, Concept of stress and strain at a point. **05 Lectures**
- 5. Quantum Mechanics:** Need of Quantum mechanics, Wave-particle duality, Matter waves, Phase velocity & Group velocity, Significance & normalization of wave function, Eigen functions & Eigen values, Time dependent and independent Schrodinger wave equation, Particle in a box (One Dimensional Case). **05 Lectures**
- 6. Physics of materials:** Electronic materials; dielectrics and ferroelectrics, Magnetic materials; dia, para, ferro and ferrimagnetic, Concept of domain theory, Ferrites, B-H curve, Magnetic anisotropy, Magnetostriction, Superconductivity, Meissner effect, Type I & Type II superconductors, London equations, Brief introduction to BCS theory, Applications of superconductivity, Introduction to nanomaterials, Surface to volume ratio, Classification and properties of nanomaterials, Applications, potential and risks of nanomaterials. **09 Lectures**


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Page 2 of 3

Text Books

- (1) M. N. Avadhanulu, "A Text Book of Engineering Physics", S. Chand Publishers, revised edition, 2014.
- (2) Serway & Jewett, "Physics for Scientists & Engineers" (Vol. I & II), Cengage Learning, 6th edition.
- (3) M. N. Khan, S. Panigrahi, "Principles of Engineering Physics" (Vol. I & II), Cambridge University Press, 1st edition, 2016.
- (4) D. R. Joshi, "Engineering Physics", McGraw Hill, 1st edition, second reprint, 2014.

Reference Books

- (1) D. J. Griffiths, "Introduction to Electrodynamics", Prentice Hall of India, 4th edition, 2012.
- (2) B. B. Laud, "Lasers & Non-Linear Optics", New Age International Ltd., 3rd edition, 2015.
- (3) K. Thyagarajan, A. K. Ghatak, "Lasers: Fundamentals & Applications", Springer, 2nd edition, 2010.
- (4) J. C. Palais, "Fibre Optic Communication", Pearson India, 5th edition, 2011.
- (5) S. M. Sze, "Semiconductor Devices: Physics & Technology", Wiley, 1985.
- (6) Milman and Halkias, "Integrated Circuits", Tata McGraw Hill, 2001.
- (7) Ben G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.
- (8) M. K. Harbola, "Engineering Mechanics", Cengage Learning, 2nd edition, 2013.
- (9) M. K. Verma, "Introduction to Mechanics", University Press, 2nd edition, 2016.
- (10) S. H. Crandall, N. C. Dhall and T. J. Lardner, "An Introduction to the Mechanics of Solids", McGraw Hill, 2nd edition with SI Units.
- (11) E. P. Popov, "Engineering Mechanics of Solids", Pearson Education, 1998.
- (12) D. J. Griffiths, "Quantum Mechanics", Pearson Education, 2008.
- (13) Richard Robinett, "Quantum Mechanics", OUP, 2006.
- (14) B. S. Rajput, "Advanced Quantum mechanics", Pragati Parkashan, 2013.
- (15) W. D. Callister, "Material Science & Engineering", John Wiley & Sons, 7th edition, 2007.
- (16) D. Wei, "Solid State Physics", Cengage Learning, 1st edition, 2008.
- (17) M. Tinkham, "Introduction to Superconductivity", Dover Publications, 2nd edition, 1996.
- (18) R. Rakesh, "Nanotechnology", S. Chand Publishers, 2nd edition, 2014.
- (19) A. K. Bandyopadhyay, "Nanomaterials", New Age International Ltd., 2nd edition, 2017.
- (20) Charles Poole, Frank Owens, "Introduction to Nanotechnology", Wiley, 2007.

Online Resources

- (1) Electromagnetism: <http://nptel.ac.in/courses/115104088/> [accessed on 24.05.2018]
- (2) Lasers: <http://nptel.ac.in/courses/104104085/> [accessed on 24.05.2018]
- (3) Fiber optics: <http://nptel.ac.in/courses/117104127/> [accessed on 24.05.2018]
- (4) Semiconductors: <http://nptel.ac.in/courses/117103063/> [accessed on 24.05.2018]
- (5) Solid mechanics: <http://nptel.ac.in/courses/112107147/> [accessed on 24.05.2018]
- (6) Quantum mechanics: <http://nptel.ac.in/courses/115102023/1> [accessed on 24.05.2018]
- (7) Dielectrics: <http://nptel.ac.in/courses/115101005/20> [accessed on 24.05.2018]
- (8) Ferroelectrics: <http://nptel.ac.in/courses/113105015/19> [accessed on 24.05.2018]
- (9) Superconductivity: <http://www.nptel.ac.in/courses/115101012/> [accessed on 24.05.2018]
- (10) Nanotechnology: <http://nptel.ac.in/courses/118102003/> [accessed on 24.05.2018]
- (11) Khan academy (Free online courses): <https://www.khanacademy.org/>

Subject Code: BSC-102

Subject Name: Physics Laboratory

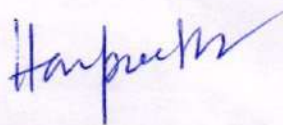
Programme: B.Tech.	L:0 T:0 P:2
Semester: 1 st / 2 nd	Teaching Hours: 20
Theory/Practical: Practical	Credits: 1
Internal Marks: 30	Percentage of numericals/design/programming problems - N.A.
External Marks: 20	Duration of End Semester Exam(ESE): 3hrs
Total Marks: 50	Course Status: Compulsory

Prerequisites: Basic knowledge of least count, vernier calliper, screw gauge.
Additional Material Allowed in ESE: N.A.

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

CO #	Course Outcome (CO)
1.	Understand the importance of least count of instruments and errors in measurements and their propagation in the calculated results.
2.	Compare the quality of different lasers and their applications in different optical processes.
3.	Find the losses taking place in optical fibers and understand the working of an optical communication system.
4.	Control the motion of charged particle in external electric and magnetic fields and use this property for analyzing different ac and dc circuits.
5.	Understand the minute details of optical phenomena like interference, diffraction and polarization.
6.	Study properties of different electric and magnetic materials viz.: dielectric constant, polarizability, change in dimensions in external electric and magnetic fields, resistivity and energy gap in semiconductors.


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Page 1 of 2

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Detailed Contents:

Sr. No.	Name of the Practical
1.	Basic knowledge of least count and error analysis (Vernier calipers and Screw gauze).
2.	To find the divergence of given Laser.
3.	To study diffraction using Laser beam and hence determine the wavelength of Laser beam.
4.	To determine thickness of a glass plate using Michelson's Interferometer.
5.	To determine the numerical aperture of an optical fiber.
6.	To study the losses in an optical fiber.
7.	To find the value of Planck's constant and photoelectric work function of the material of cathode using a solar cell.
8.	To obtain the waveform of a given oscillator/A.C. Mains using CRO.
9.	To study B-H curve using CRO.
10.	To find the velocity of ultrasonic waves in a given liquid.
11.	To find the dielectric constant of a substance.
12.	Introduction to spectrometer and its use to find the angle of prism.
13.	To find resistivity and energy gap of a semiconductor using four probe method.
14.	To study the rotation of plane of polarization of plane polarized light using sugar solution.

Note: Each student is required to perform at least Eight experiments from 1-14 and first experiment is compulsory.

Suggested Books:

1. C L Arora, "Practical Physics", S. Chand & Co., 2010.
2. R S Sirohi, "Practical Physics", Wiley Eastern.
3. Harnam Singh, P. S. Hemne, "Practical Physics", S. Chand & Co., 4th edition.


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Page 2 of 2




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PAGE ...5... OF ...28

Mathematics-I(BSC-103)

1st Semester

Internal Marks: 40

External Marks: 60

Total Marks: 100

Course Outcomes

After studying this course, students shall be able to :

- Analyze the use of calculus and linear algebra to Engineering problems.
- Apply the concept of improper integrals to study Beta and Gamma functions.
- Explain utility of Taylor's theorem in error analysis.
- Apply the concept of rank to solve system of linear equations and diagonalization of matrices.
- Recognize and solve ordinary and linear differential equations.
- Infer the convergence of infinite series.

L	T	P	C
3	1	0	4

Detailed Contents:

PART A

1. Improper Integral: Evaluation of improper integrals, Beta and Gamma functions and their properties. **04 Hrs**

2. Ordinary Differential Equations: Exact, Leibnitz and Bernoulli's equations, Euler's equations, equations of first order and higher degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's equation. **08 Hrs**

3. Linear Differential Equations of Higher Orders: Second order linear differential equations with constant coefficients, method of variation of parameters, Cauchy-Euler equation; Legendre's equation. **08 Hrs**

PART B

4. Differential Calculus: Taylor's and Maclaurin theorems with remainders (without proofs), exponential, trigonometric and logarithm series, indeterminate forms and L'Hospital rule. **04 Hrs**

5. Infinite series: Introduction to sequence, convergence of infinite series, tests for convergence (comparison, ratio, root, Cauchy integral test), power series, alternating series. **06 Hrs**

6. Matrices: Inverse and rank of a matrix, row reduced echelon form, system of linear equations, linear dependence and independence of vectors, symmetric, skew-symmetric and orthogonal matrices.

determinants, eigen values and eigen vectors, similar matrices, diagonalization of matrices, Cayley Hamilton Theorem(without proof) and its applications to find inverse and calculation of powers of square matrices.

10 Hrs

Suggested Readings/Books:

1. G.B. Thomas and R.L. Finney, *Calculus and Analytic geometry*, 9th Edition, Pearson, Reprint, 2002.
2. R.K.Jain and S.R.K.Iyengar, *Advanced Engineering Mathematics*, Narosa Publications, New Delhi.

References:

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., *Engineering Mathematics for first year*, Tata McGraw Hill, New Delhi, 2008.
3. Ramana B.V., *Higher Engineering Mathematics*, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. D. Poole, *Linear Algebra: A Modern Introduction*, 2nd Edition, Brooks/Cole, 2005.
5. N.P. Bali and Manish Goyal, *A text book of Engineering Mathematics*, Laxmi Publications, Reprint, 2008.
6. B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 36th Edition, 2010.

Topics for Self Learning(TSL)

1. Trigonometric formulas.
2. Methods of differentiation.
3. Methods of integration.
4. Basic properties of matrices and determinants.

27/1/20


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Principles of Engineering Economics and Management (HSMC-103)

External Marks: 60

L T P C

Internal Marks: 40

2 1 0 3

Total Marks: 100

Numerical percentage = 40 %

OBJECTIVES: The students should understand economics, demand, production cost, factor pricing, cost estimate of projects, costing, investment alternatives, techniques for optimal utilization of resources.

Part A

Basic concepts and definition

(2 hrs)

Demand, supply, cost, price, profit, fixed cost, variable cost, total cost, average cost, marginal cost, total productivity, marginal productivity, average productivity, Definition of economics.

Theory of demand

(2 hrs)

Law of Demand, Elasticity of demand, Indifference curve analysis, Consumer surplus and Engel's law of economics, Giffen's paradox.

Production and cost

(3 hrs)

Factors of production, Law of returns to scale, law of variable proportions, Internal and external economies and diseconomies, cost analysis

Factor Pricing

(2 hrs)

Marginal productivity theory, Modern theory of factor pricing

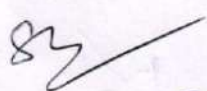
Part B

Management

(1hr)

Definition & Principles of Management (F. W Taylor & Henry Fayol)


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Cost accounting**(4 hrs)**

Costing and aid to management, general principle of cost accounting, cost analysis, concepts, classification and cost sheet, economic order quantity

Marginal costing**(2 hrs)**

Marginal costing and Break-even analysis, Breakeven chart

Replacement Studies**(4 hrs)**

Reasons for replacement, factors to be considered in replacement Studies, payback method, average rate of return, internal rate of return, present value method, challenger and defender

TEXT BOOKS

1. Principles of economics by P.N. Chopra
2. Principles of economics by H. L. Ahuja
3. Elementary economic theory by K.K. Dewett
4. Cost and management accounting by S.P. Jain, K.L. Narang
5. Accounting and financial management by Shashi K. Gupta, Dr.R.K. Sharma, Anju Gupta

REFERENCE BOOKS

1. Labour Problems and Social Welfare (K. Math & Co. Meerut) by R.C. Saxena
2. Economics of Labour and Industrial Relations (Sahitya Bhawan Agra) by T.N. Bhagoliwal
3. Managerial Economics by K K Seo, Richard D Irwin 1992.
4. Economics, P A Samuleson, Tata McGraw Hill Publishers New Delhi 1997.
5. Micro Economics analysis by A. Koutsoyiannis
6. Management accounting by Charles T Harngren


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ESC-101 BASIC ELECTRICAL ENGINEERING

Internal Marks:40
External Marks:60
Total Marks: 100

L	T	P	C
3	1	0	4

COURSE OUTCOMES

- Analyze the behavior of electrical and magnetic circuits.
- Inculcate the understanding about the AC fundamentals.
- Realize the requirement of transformers in transmission and distribution of electric power and other applications.
- Select the type of generator / motor required for a particular application.
- Analyze the various electrical networks.
- Understand the components of low voltage electrical installations

CONTENTS

Part-A

Module 1:DC Circuits

(L-6)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and Voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Star Delta and Delta Star transformation.

Module 2: AC Circuits

(L-8)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers

(L-6)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Part-B

Module 4:Electrical Machines

(L-8)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

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Module 5: Electrical Installation

(L-8)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries, Elementary calculations for energy consumption, power factor improvement and battery backup.

Module 6: Basic Instruments

(L-6)

Introduction, classification of instruments, operating principles, permanent magnet moving coil and moving iron instruments

BOOKS RECOMMENDED

1. Vincent Del Toro, "Electrical Engineering Fundamentals", PHI Learning Pvt Ltd.
2. S.K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Education, 2012.
3. D.P. Kothari & I.J. Nagrath, "Theory and Problems of Basic Electrical Engineering", PHI Learning Pvt Ltd.
4. V.K. Mehta, "Principles of Electrical Engineering", S. Chand Publishers.
5. David V. Kerns, JR. J. David Irwin "Essentials of Electrical and Computer Engineering", Pearson Education.
6. B.L. Theraja and A.K. Theraja "A Textbook of Electrical Technology" S. Chand Publishers.
7. H. Cotton, "Electrical Technology", CBS Publishers.
8. Van Valkenburgh, "Basic Electrical Engineering", Cengage Learning.
9. Rizzoni, "Principles and Application of Electrical Engineering", McGraw Hill Publishers.
10. Stanley, Hackworth Jones, "Fundamentals of Electrical Engineering and Technology", Cengage Learning.

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ESC-102BASIC ELECTRICAL ENGINEERINGLABORATORY

Internal Marks:30

L T P C

External Marks:20

0 0 2 1 ✓

Total Marks:50


COURSE OUTCOMES

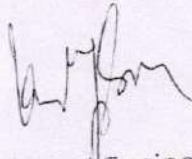
Students attain ability to:

- Recognize different electrical components like resistances, inductances, capacitances and their ratings.
- Verify and interpret basic laws of electric circuits like Ohm's Law and Kirchhoff's Law and same are demonstrated in their field placements.
- Design electric circuits and utilize electric instruments to perform experiments.
- Detect ratings of commonly used house hold electrical appliances.
- Acquire practical knowledge of electric circuit's components and instruments.
- Understand the basic characteristics of transformers and electrical machines.

LIST OF EXPERIMENTS

- To verify Ohms Law and its limitations.
- To verify Kirchhoff's Laws.
- To measure the resistance and inductance of a coil by ammeter-voltmeter method.
- To find voltage-current relationship in an R-L series circuit and to determine the power factor of the circuit.
- To verify the voltage and current relations in star and delta connected systems.
- To measure power and power factor in a single-phase AC circuit.
- To verify series and parallel resonance in AC circuits.
- To observe the B-H loop of ferromagnetic core material on CRO.
- To study Synchronous machine as a generator.
- To draw Torque Speed characteristics of dc motor.
- To start and reverse the direction of rotation of a)DC motor b) 3 Phase Induction motor
- To Convert Voltmeter to ammeter & Vice Versa.
- To Study the use of multimeter.
- To analyze different connections of Single phase Induction motor.
- To study the different connections of three phase transformer.


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B.Tech. (Common) Batch 2018 Onwards**1st/2nd Semester ESC-103 ENGINEERING GRAPHICS AND DESIGN****Internal Marks: 40****L T P C****External Marks: 60****1 0 4 3****Total Marks: 100****Course Outcomes:**

At the end of the course, the student shall be able to

1. Understand various terms used in engineering drawing and Interpret the drawing in terms of engineering requirement.
2. Conceptualize, and deliver the fundamentals of engineering drawing for any given application.
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 requirement.
5. Integrate ideas for offering efficient and effective solutions to the engineering problems.
6. Use computer to draw engineering drawings (2D) and basic 3D models.


PART – I [THEORY]

1. **Introduction:** Drawing equipment/ instruments and their use; Rules and conventional/ symbolic representation related to engineering practices as per international/ national standards SP46:2003 and IS 962-1989. **(02 Hours)**
2. **Theory of Projections:** Concept of projections and its types (orthographic, Isometric, Auxiliary and perspective); System of orthographic projection with reference to quadrants and octants for points, lines, lamina and solids. **(04 Hours)**
3. **Section of Solids:** Definition of sectioning and its purpose; Types of sectional planes and their applications (orthographic) **(02 Hours)**
4. **Development of Surfaces:** Purpose of development; Use of parallel line and radial line methods. **(01 Hours)**
5. **Isometric Views/Projections:** Concept of isometric view/projection; Difference between isometric projection and isometric drawing; Isometric projection of lamina and solids. **(01Hours)**
6. **Computer Graphics and Design:** User graphic interface; Menu system; Toolbar options; Basic initial setting; User coordinate system (UCS) & world coordinate system (WCS) and viewing of the drafting software interfaces; Draw basic entities in 2D, modification, dimensioning and tolerancing of these entities, constraints & parametric dimensioning, methods of zoom and panning; Short cut keys to execute commands and options; Create, edit and use customized layers; Print scale setting; ISO and ANSI standards for coordinate dimensioning and tolerance; Solid primitive's constructions, working with regions, Creating solid model by extrusions, revolutions; Use of extrude and revolve commands as construction tools; Changing properties; Aligning objects in 3D, 3D rotating, 3D mirroring, creating 3D arrays; filleting solid objects, chamfering solid objects, constructing details and features on solid models, and removing details and features; displaying 3D views. **(03 Hours)**

PART-II [PRACTICE (DRAWING)]

1. Planning of drawing sheet layout; Use of scales (IS:10713-1 1983); Technical lettering; Conventional representation of lines as per SP46:2003; Principles of dimensioning. **(04 Hours)**


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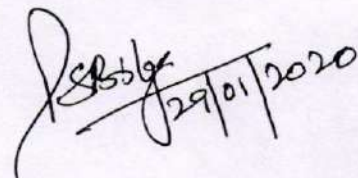
2. **Orthographic Projections of Points:** Practice through problems in quadrants and octants. (04 Hours)
3. **Orthographic Projections of Lines:** Determine/find out true length of line, true angle of inclination of line with HP, true angle of inclination of line with VP, Horizontal Trace of line, Vertical Trace of line for different cases: (i) Line is parallel to both HP and VP (ii) Line is contained by profile plane (iii) Line is parallel to one plane and inclined to other plane (iv) Line is inclined to both HP and VP by Rotation and Trapezoid methods only. (08 Hours)
4. **Orthographic Projections of Lamina:** Practice through various positions: (i) Lamina is parallel to one plane and perpendicular to other (ii) Lamina is perpendicular to one plane and inclined to other (iv) Lamina is inclined to both reference planes. (04 Hours)
5. **Orthographic Projections of Solids:** Practice through various cases (i) Axis is parallel to one plane and perpendicular to other plane (ii) Axis is parallel to one plane and inclined to other plane (iii) Axis is parallel to both HP and VP (iv) Axis is inclined to both HP and VP. (08 Hours)
6. **Section of Solids:** Practice through various cases (i) Parallel to HP (ii) Parallel to VP (iii) Inclined to one plane and perpendicular to other (iv) perpendicular to both HP and VP. (04 Hours)
7. **Development of Surfaces:** Practice through examples using parallel line and radial line methods. (04 Hours)
8. **Isometric Projections:** Illustration through examples for lamina and solids both. (04 Hours)
9. Reading, understanding and interpretation of engineering drawings (Industrial/Commercial/Transportation/Domestic sector) (02 Hours)
10. **Computer Graphics and Design:** Illustration of the contents of theory part through examples using 2D and 3D commands; Generation of basic 3D of some simple industrial part/component, its 3D assembly, generation of associated 2D with inclusion of part bill of material. (10 Hours)

Suggested Readings / Books

1. Agrawal B. and Agrawal C. M., "Engineering Graphics", Tata McGraw Hill Publishing Company Limited, 1st Edition, 2008, New Delhi.
2. Gill P. S., "Engineering Graphics and Drafting", S.K. Kataria and Sons, 1st Edition, 2000, New Delhi.
3. Bhatt N. D. and Panchal V. M., "Elementary Engineering Drawing - Plane and Solid Geometry", Charotar Publishing House, 37th Edition, 1996, Anand.
4. Parthasarathy N. S. and Murali V., "Engineering Drawing", Oxford University Press, 1st Edition, 2016, New Delhi.
5. Bertoline G. R., Wiebe E. N., Miler G. L. L. and Mother J. L., "Technical Graphics Communication", Irwin McGraw Hill, 6th Edition, 2010, New York.
6. George O. and Brian C. B., "Mastering AutoCAD 2018 and AutoCAD LT 2018" by AUTODESK.


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29/01/2020

Mathematics-II
BSC-104

2nd Semester

L	T	P	C
3	1	0	4

Internal Marks: 40

External Marks: 60

Total Marks: 100

Course Outcomes

After studying this course, students shall be able to :

- Understand and apply concepts of vector calculus, differential equations and calculus of complex functions to engineering problems.
- Sketch basic cartesian, parametric and polar curves.
- Apply the techniques of multiple integrals in engineering problems.
- Evaluate integrals of vector point functions over line, surfaces and volumes.
- Substantiate the ability to integrate knowledge and ideas of multivariable calculus to engineering problems.
- Understand how to decompose the periodic functions in series of sine and cosine.

Detailed Contents:

PART A

1. Fourier Series: Periodic functions, even & odd functions, Euler's formulae for Fourier series, Dirichlet's conditions, half range Fourier series. **05 Hrs**

2. Curve tracing: Introduction to maxima, minima, concavity, convexity, points of inflexion, tracing of basic cartesian, parametric and polar curves. **07 Hrs**

3. Partial Differentiation: Limit, continuity and partial derivatives, composite functions, total derivative. Applications: tangent plane and normal line, maxima, minima and saddle points, method of Lagrange multipliers, Taylor's and Maclaurian expansions for functions of two variables, errors and approximations. **08 Hrs**

PART B

4. Multiple Integral: Double integrals (cartesian, polar co-ordinates), change of order of integration, change of variables, applications of double integrals to find areas and volumes. Triple integrals (cartesian, spherical and cylindrical polar co-ordinates), applications of triple integrals to find volume involving cubes, sphere and rectangular parallelepipeds. **10 Hrs**

5.Vector Calculus: Del, directional derivative, gradient, curl, divergence, scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes (without proof) and their applications. **10 Hrs**

Suggested Readings/Books:

1. G.B. Thomas and R.L. Finney, *Calculus and Analytic geometry*, 9th Edition, Pearson, Reprint, 2002.
- 2 R.K.Jain and S.R.K.Iyengar, *Advanced Engineering Mathematics*, Narosa Publications, New Delhi.

References:

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, *Elementary Differential Equations and Boundary Value Problems*, 9th Edn., Wiley India, 2009.
3. S. L. Ross, *Differential Equations*, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, *An Introduction to Ordinary Differential Equations*, Prentice Hall India, 1995.
5. E. L. Ince, *Ordinary Differential Equations*, Dover Publications, 1958.
6. J. W. Brown and R. V. Churchill, *Complex Variables and Applications*, 7th Ed., Mc-Graw Hill, 2004.
7. N.P. Bali and Manish Goyal, *A text book of Engineering Mathematics*, Laxmi Publications, Reprint, 2008.
8. B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 36th Edition, 2010.

Topics for Self Learning(TSL)

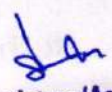
1. Trigonometric formulas.
2. Methods of differentiation.
3. Methods of integration..
4. Variable separable method.
5. Solution of homogeneous first order differential equations.

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I/II Semester

BSC- 105 Chemistry

Internal Marks: 40

L T P C

External Marks:60

3 1 0 4

Total Marks:100

COURSE OUTCOME:

After studying this course, the students should be able to :

1. Understand important properties of simple and complex molecules and apply it to explain the behaviour of materials.
2. Identification of molecules (simple and complex) based on their excitation in different molecular orbitals.
3. Interpret the phase diagram and use it in industry.
4. Apply the principles of water chemistry, on characteristics of surface water, drinking water , waste water and in industrial applications.
5. Analyse relationships between different thermodynamic functions with electrochemistry.
6. Understand the basic concept of different types of interactions in molecules and use it to explain their stereochemistry and identify major chemical reactions used in synthesis of molecules.

Detailed Content

PART-A

1. **Atomic and molecular structure** : Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structure. **04Hrs**
2. **Spectroscopic techniques and applications** : Principles of spectroscopy and selection rules. Beer-Lambert's Law . Electronic spectroscopy; Auxochrome, chromophore, electronic transition, bathochromic shift, hypsochromic shift, hyperchromic shift and hypochromic shift. Calculation of wavelength maxima by Woodward Fieser Rule and its applications. Vibrational spectroscopy ; Fundamental vibrations, Fingerprint and functional group region, Interpretation of spectra, Hooks law and its Applications. Principles and applications of ^1H NMR and ^{13}C NMR Spectroscopy. **09 Hrs**
3. **Water Chemistry** : Introduction, Hardness and Alkalinity of water, units and determination, Analysis and water quality parameters, Softening of water by lime-soda method, EDTA, Ion-exchange method and Zeolite method, Boiler feed water: Specifications, Scale and sludge formation, Priming, Foaming and Boiler corrosion. Different methods for water purification. Desalination of Brackish water. Removal of heavy metals using nanomaterials. **07 Hrs**

PART-B

4. **Intermolecular forces and potential energy surfaces** :Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. **03Hrs**


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PAGE ...17... OF ...28...


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5. **Use of free energy in Chemical equilibria & Phase equilibria :** Thermodynamic functions: Energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Numerical problems. **05 Hrs**
Phase diagrams of water system (one component system), lead- silver system and KI-water system(two component system). **04 Hrs**

6. **Stereochemistry & Organic reactions:** Structural isomers and stereoisomers, configurations and conformational analysis- R,S,E and Z, conformations- eclipsed , staggered, skew, chair and boat form of cyclohexane . Symmetry, chirality, enantiomers, diastereomers, optical activity. **04 Hrs**

Introduction to reactions involving substitution-electrophilic and nucleophilic, addition, elimination- E1 and E2, oxidation and reduction using different reagents. Synthesis of Aspirin and Acetaminophen. **04Hrs**

Suggested Readings/Books:

1. PC Jain and Monica Jain, "Engineering Chemistry" , Dhanpat Rai Publication, 14th Edition, 2002.
2. B R Puri, LR Sharma and MD Pathania, "Principles of Physical Chemistry, Vishal Publishing Co., 46th edition, 2013.
3. RT Morrison and RN Boyd, " Study Guide to Organic Chemistry" Pearson Prentice Hall, 6th Edition, 2007.
4. P. Atkins and J. de Paula., "Atkin's Physical Chemistry", Oxford University Press, 10th Edition, 2014.
5. B. L. Tembe, Kamaluddin and M. S. Krishnan , "Engineering Chemistry (NPTEL Web-book).

Asad
06-01-2020

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I/II Semester

BSC- 106 Chemistry Lab.

Internal Marks: 30

L T P C

External Marks:20

0 0 2 1

Total Marks:50

COURSE OUTCOME:

After studying this course, the students should be able to :


1. Synthesize a small molecules(drugs/polymers) .
2. Know to maintain different reaction conditions to get maximum yield of the product, if possible by green chemistry approach.
3. Correlate the impurities with hardness, chloride content and alkalinity of water.
4. Remove hardness of water to make it fit for industrial use.
5. Select a lubricant for particular type of a machine and analyse the importance of temperature for viscosity.
6. Be able to handle sophisticated instruments to interpret the results (pH, conductance, wavelength absorbed) to calculate some important parameters of the sample(conc., redox potentials etc.)

Choice of 10 experiments from the following:

1. Determination of hardness of water by EDTA method.
2. Determination of chloride content in water.
3. Determination of alkalinity in water.
4. Determination of metal ions present in a water sample .
5. Ion exchange column for removal of hardness of water.
6. Determination of absolute and relative viscosity of lubricant.
7. Determination of conc. of solution conductometrically.
8. Determination of conc. of solution pH metrically.
9. Determination of wavelength abs. and unknown conc. of solution.
10. Determination of Surface Tension of a Liquid using Stalagmometer.
11. Prepration of a polymer.
12. Prepration of aspirin.
13. Determination of redox potentials and emfs using potentiometer.


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PAGE ...19... OF ...28...



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Suggested Readings/Books:

1. P C Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publication, 14th Edition, 2002.
2. S Rattan, "Experiments in Applied Chemistry", S K Kataria & Sons, 1st Edition, 2002.
3. BS Furniss, "Vogel's Textbook of Practical Organic Chemistry", Pearson Education, 5th Edition, 2006.

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Programming for Problem Solving (ESC-104)

L: 3; T:1; P: 0 (4 credits)]

Detailed contents:

Part A

Unit 1: Introduction to Programming,

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

[4]

Unit 2: Arithmetic expressions and precedence

Conditional Branching and Loops

Writing and evaluation of conditionals and consequent branching

Iteration and loops

[8]

Unit 3: Arrays

Arrays (1-D, 2-D), Character arrays and Strings

[6]

Unit 4: Basic Algorithms

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition require)

[6]

Part B

Unit 5: Function

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

[5]

Unit 6: Recursion

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

[4]

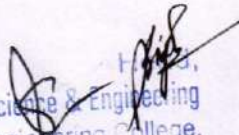
Unit 7: Structure

Structures, Defining structures and Array of Structures

[4]

Unit 8: Pointers


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PAGE 21 OF 28

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

[2]

Unit 9: File handling (only if time is available, otherwise should be done as part of the lab)

[3]

Suggested Text Books

- (i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
- (ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

- (i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.


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Programming for Problem Solving Laboratory (ESC-105)

[L: 0; T:0; P:2 (1credits)]

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Lab 1: Familiarization with programming environment

Lab 2: Simple computational problems using arithmetic expressions

Lab 3: Problems involving if-then-else structures

Lab 4: Iterative problems e.g., sum of series

Lab 5: 1D Array manipulation

Lab 6: Matrix problems, String operations

Lab 7: Simple functions

Lab 8: Programming for solving Numerical methods problems

Lab 9: Recursive functions

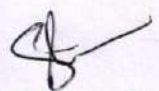

Lab 10: Pointers and structures

Lab 11: File operations

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use them in defining self-referential structures.
- To be able to create, read and write to and from simple text files.


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ESC-106 Manufacturing Practice1st & 2nd Semester

Internal Marks:30

External Marks:20

Total Marks:50

L	T	P	C
0	0	4	2

COURSE OUTCOMES

- Make various carpentry utility items with use of various joints.
- Practice of various forging, welding, electric, sheet metal tools and equipments.
- Make mould and cast product of different shapes.
- Finish various jobs by using finishing tools.
- Operate different machines and perform different operations.

1. Carpentry and Pattern Making: Various types of timber and practice boards, defects in timber, seasoning of wood; tools, wood operation and various joints; exercises involving use of important carpentry tools to practice various operations and making joints.

2. Foundry Shop: Introduction to molding materials; moulds; use of cores; melting furnaces; tools and equipment used in foundry shops; firing of a cupola furnace; exercises involving preparation of small sand moulds and castings.

3. Forging Practice: Introduction to forging tools; equipments and operations; forgability of metals; exercises on simple smithy; forging exercises.


4. Machine Shop: Machines, Grinders etc; cutting tools and operations; exercises involving awareness.

5. Welding Shop: Introduction to different welding methods; welding equipment; electrodes; welding joints; welding defects; exercises involving use of gas/electric arc welding.

6. Electrical and Electronics Shop: Introduction to electrical wiring; preparation of PCBs involving soldering applied to electrical and electronic applications; exercises preparation of PCBs involving soldering applied to electrical and electronic applications.

7. Sheet Metal: Shop development of surfaces of various objects; sheet metal forming and joining operations, joints, soldering and brazing; exercises involving use of sheet metal forming operations for small joints.

8. Fitting Shop: Introduction of fitting practice and tools used in fitting shop; exercise involving marking, cutting, fitting practice (Right Angles), male-Female mating parts practice, trapping practice.


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PAGE 24 OF 28


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 29/1/2020

HSMC-101 ENGLISH

1st /2nd Semester

Internal Marks: 40

External Marks: 60

Total Marks: 100

L	T	P	C
3	0	0	3

COURSE OUTCOMES

After studying this course, the students shall be able to:

- Grasp the significance of effective communication in English at work places.
- Acquire effective listening skills and reading skills for academic and professional efficiency.
- Present their thoughts and ideas in an organized way in written form.
- Enhance grammatical competence in English through lessons on English language usage.
- Utilise suitable writing styles while expressing themselves in written form in English.
- Produce effectively different forms of professional writing.

Section -A

1. INTRODUCTION TO COMMUNICATION IN ENGLISH

Importance of communication

Importance of Communicating in English

Communication: Concept of Communication; Process of communication; Modes of Communication: formal and Informal Communication; Oral and Written; Verbal and Non-verbal. Classification of Non-verbal Communication-Kinesics, Proxemics and Paralanguage.

Basics of Effective Communication.

Language as a tool of Communication; Characteristics of Language (06Hrs.)

Barriers to Communication

2. LISTENING SKILLS

Importance of Listening in Communication; Poor Listening habits; Types of Listening; Qualities of a good Listener; Barriers to Effective Listening. (03 Hrs.)

3. READING SKILLS

Reading Process; Reading Strategies; Intensive Reading Skills; Reading Comprehension (03 Hrs.)

Section -B

4. BASIC WRITING SKILLS

Sentence structures; Use of phrases and Clauses in sentences; Creating Coherence; Organising Principles of Paragraphs in documents; Paragraph Writing (04 Hrs.)

5. IDENTIFYING COMMON ERRORS IN WRITING

Subject Verb Agreement

Noun-Pronoun Agreement

Misplaced Modifiers

Articles and Prepositions

(04 Hrs.)

6. NATURE AND STYLE OF WRITING

Describing; Defining; Providing examples or evidence; Writing Introduction and Conclusion;
Essay Writing

(4 Hrs.)

7. COMMUNICATION AND TECHNICAL WRITING

Business Letter Writing: Complaint letter, Collection Letter, Sales Letter, Inquiry Letter,
Order Placement Letter; Job Application and Resume Writing; E-mail Writing; Structuring a
Project Report

(06Hrs.)

Suggested Readings/Books:

M. Ashraf Rizvi, "Effective Technical Communication" McGraw Hill

Meenakshi Raman & Sangeeta Sharma, "Fundamentals of Technical Communication"
Oxford university Press.

Chrissi Wright, "Handbook of Practical communication" Jaico Publishing House, Mumbai

Asha Kaul, "Effective business Communication" Prentice Hall of India.

Sunita Mishra & C. Mualikrishna, "Communication Skills For Engineers" Pearson Education.

"Practical English Usage." Michael Swan. OUP. 1995


"Remedial English Gramma". F.T. Wood, Macmillan. 2007

"On Writing Well" William Zinsser. Harper Resource Book. 2001

"Study Writing". Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.

"Communication Skills." Sanjay Kumar and Pushpa Lata. Oxford University Press. 2011


27/11/19


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HSMC-102 ENGLISH Laboratory

1st /2nd Semester

Internal Marks: 40

External Marks: 60

Total Marks: 100

L	T	P	C
0	0	2	1

COURSE OUTCOMES

After studying this course, the students shall be able to:

- Develop a knack for structured public talk.
- Grasp the nuances of interpersonal skills through conversation and dialogues.
- Acquire proficiency in skills involved in effective participation in group discussion.
- Perform satisfactorily in job interviews for career settlement and growth.
- Demonstrate fluency in speech in acceptable accent.
- Receive and understand spoken material accurately.

Detailed Contents:

1. Oral Presentation: Power Point PRESENTATIONS

THEORETICAL BASIS: Importance of Oral Presentation; Elements of Effective Presentation. Outlining and Structuring: Guidelines for Effective Delivery. Visual Aids.

2. Seminar Presentation

Theoretical basis: Guidelines for effective seminar presentation. Handling question answer session.

3. Group Discussion-: GD practice sessions

Theoretical basis- Nature of Group Discussion; Characteristics of Group Discussion; Group Discussion strategies. GD practice sessions

4. Job Interviews - Mock Interviews


Theoretical Basis :- Purpose and Process of Job Interview; Pre-Interview Preparation Techniques; Interview Question answering Strategies; Frequently Asked Questions; Projecting a Positive Image.

5. British Accent-English Sound System; Pronunciation and Stress Placement

6. Listening Comprehension-Listening to a recorded talk and participation in conversation.


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PAGE 27 OF 28


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7. Conversation and Dialogues.

Suggested Readings/Books

R.K. Bansal & J.B. Harrison "Spoken English" Orient Longman.

J.Sethi, Kamlesh Sadanand & D. V. Jindal , "A Practical Course in English Pronunciation"
Prentice Hall of India Pvt. Ltd. New Delhi.

T. Balasubramaniam, "A Text book Of English Phonetics for Indian Students" Macmillan
Daniel Jones," English Pronouncing Dictionary" Current Edition with CD

Rosetta Stone English Library

Murphy's English Grammar with CD. Cambridge

M.Ashraf Rizvi" Effective Technical Communication" Tata McGraw Hills.

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