

# **SHRI VENKATESHWARA UNIVERSITY**



## **Syllabus**

**B.TECH**  
**Mechanical Engineering**  
**I<sup>st</sup> SEMESTER**  
(Four Years Degree Programme)

(w.e.f. 2019-20)

**SCHOOL OF ENGINEERING & TECHNOLOGY**

Sl No.	Subject Code s	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	C T	T A	Tot al	P S	TE	P E		
1	BSC - 101	Physics	3	1	0	20	10	30		70		100	4
	BSC- 102	Mathematics –I	3	1	0	20	10	30		70		100	4
3	ESC- 103	Basic Electrical Engineering	3	1	0	20	10	30		70		100	4
4	ESC - 104	Engineering Graphics & Design	0	0	4				25		25	50	2
5	HMC- 105	English	2	0	0	20	10	30			70	100	2
6	BSC - 111	Physics Lab	0	0	4				25		25	50	2
7	ESC- 113	Basic Electrical Engineering Lab	0	0	4				25		25	50	2
8.	HMC- 115	English Lab	0	0	2				25		25	50	1
												<b>600</b>	<b>21</b>

Course code	BSC-101				
Category	Basic Science Course				
Course title	Physics				
Scheme and Credits	L	T	P	Credits	Semester-I
	3	1	0	4	
	<u>Course contents in Physics</u> (i) Introduction to Mechanics				

Introduction to Mechanics [L : 3; T:1; P : 0 (4 credits)]

**Pre-requisites  
(if any)**

High-school education

*Detailed contents:*

UNIT 1: (8 lectures)

Transformation of scalars and vectors under Rotation transformation; Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Solving Newton's equations of motion in polar coordinates; Problems including constraints and friction; Extension to cylindrical and spherical coordinates

UNIT 2: (7 lectures)

Potential energy function;  $F = -\text{Grad } V$ , equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum; Energy equation and energy diagrams; Elliptical, parabolic and hyperbolic orbits; Kepler problem; Application: Satellite manoeuvres;

UNIT 3: (11 lectures)

Non-inertial frames of reference; rotating coordinate system: Five-term acceleration formula. Centripetal and Coriolis accelerations; Applications: Weather systems, Foucault pendulum; Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly-damped oscillators; Forced oscillations and resonance.

UNIT 4: (5 lectures)

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples.

UNIT 5: (7 lectures)

Introduction to three-dimensional rigid body motion — only need to highlight the distinction from two-dimensional motion in terms of (a) Angular velocity vector, and its rate of change and (b) Moment of inertia tensor; Three-dimensional motion of a rigid body wherein all points move in a

coplanar manner: e.g. Rod executing conical motion with center of mass fixed — only need to show that this motion looks two-dimensional but is three-dimensional, and two-dimensional formulation fails.

*Suggested Reference Books*

- (i) Engineering Mechanics, 2<sup>nd</sup> ed. — MK Harbola
- (ii) Introduction to Mechanics — MK Verma
- (iii) An Introduction to Mechanics — D Kleppner & R Kolenkow
- (iv) Principles of Mechanics — JL Synge & BA Griffiths
- (v) Mechanics — JP Den Hartog
- (vi) Engineering Mechanics - Dynamics, 7<sup>th</sup> ed. - JL Meriam
- (vii) Mechanical Vibrations — JP Den Hartog
- (viii) Theory of Vibrations with Applications — WT Thomson

BSC -111	Physics Lab
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Suggested list of experiments from the following:

- Coupled oscillators;
- Experiments on an air-track;
- Experiment on moment of inertia measurement,
- Experiments with gyroscope;
- Resonance phenomena in mechanical oscillators.

Course code	BAS-102				
Category	Basic Science Course				
Course title	Mathematics -1 (Calculus and Linear Algebra)				
Scheme and Credits	L	T	P	Credits	Semester - I
	3	1	0	4	
Pre-requisites (if any)	-				

*Detailed contents:*

*UNIT 1: Calculus: (6 lectures)*

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

*UNIT 2: Calculus: (6 lectures)*

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

*UNIT 3: Sequences and series: (10 lectures)*

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

*UNIT 4: Multivariable Calculus (Differentiation): (8 lectures)*

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

*UNIT 5: Matrices: (10 lectures)*

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

*Suggested Text/Reference Books*

- (i) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9<sup>th</sup> Edition, Pearson, Reprint, 2002.
- (ii) Erwin kreyszig, Advanced Engineering Mathematics, 9<sup>th</sup> Edition, John Wiley & Sons, 2006.
- (iii) Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
- (iv) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11<sup>th</sup>

Reprint, 2010.

(v) D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

(vi) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

(vii) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36<sup>th</sup> Edition, 2010.

### *Course Outcomes*

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
  - The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
  - The tool of power series and Fourier series for learning advanced Engineering Mathematics.
  - To deal with functions of several variables that are essential in most branches of engineering.
  - The essential tool of matrices and linear algebra in a comprehensive manner.
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Course code	ESC-103				
Category	Engineering Science Course				
Course title	Basic Electrical Engineering				
Scheme and Credits	L	T	P	Credits	Semester –I
	3	1	0	0	
Pre-requisites (if any)	-				

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, Detailed contents:

**UNIT 1 : DC Circuits (8 hours)**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

**UNIT 2: AC Circuits (8 hours)**

voltage and current relations in star and delta connections.

**UNIT 3: Transformers (6 hours)**

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

**UNIT 4: Electrical Machines (8 hours)**

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.

**UNIT 5: Power Converters & Electrical Installations (12 hours)**

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

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.

**Suggested Text / Reference Books**

- (i) D.P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
- (ii) D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.L.S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.

- (iii) E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
- (iv) V.D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

*Course Outcomes*

- To understand and analyze basic electric and magnetic circuits
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations

<b>ESC-113</b>	<b>Basic Electrical Engineering Lab</b>
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*List of experiments/demonstrations:*

- Basic safety precautions. Introduction and use of measuring instruments–voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
  - Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
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Course code	ESC-104				
Category	Engineering Science Courses				
Course title	Engineering Graphics & Design				
Scheme and Credits	L	T	P	Credits	Semester - I
	0	0	4	2	
Pre-requisites (if any)	-				

*Detailed contents:*

*Traditional Engineering Graphics:*

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

*Computer Graphics:*

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

*(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)*

*UNIT 1: Introduction to Engineering Drawing Covering,*

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales; Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

*UNIT 2: Sections and Sectional Views of Right Angular Solids Covering,*

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only) Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

*UNIT 3: Overview of Computer Graphics Covering,*

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

*UNIT 4: Customisation & CAD Drawing*

consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, 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; applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned

surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models.

Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

*UNIT 5: Demonstration of a Simple Team Design Project that Illustrates*

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; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

*Suggested Text/Reference Books:*

- (i) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
- (ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
- (iii) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
- (iv) Narayana, K.L. & P Kannaiyah (2008), Text book on Engineering Drawing, Scitech Publishers
- (v) (Corresponding set of) CAD Software Theory and User Manuals

### *Course Outcomes*

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical,

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electrical, architectural

and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

- to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- to prepare you to communicate effectively to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice The student will learn :
- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

Course code	HMC-105				
Category	Humanities and Social Sciences including Management courses				
Course title	English				
Scheme and Credits	L	T	P	Credits	Semester - I
	2	0	2	3	
Pre-requisites (if any)	-				

### *Detailed contents*

#### 1. Vocabulary Building

- 1.1 The concept of Word Formation
- 1.2 Root words from foreign languages and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4 Synonyms, antonyms, and standard abbreviations.

#### 2. *Basic Writing Skills*

- 2.1 Sentence Structures
- 2.2 Use of phrases and clauses in sentences
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence
- 2.5 Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

#### 3. *Identifying Common Errors in Writing*

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.4 Prepositions
- 3.5 Redundancies
- 3.6 Clichés

#### 4. *Nature and Style of sensible Writing*

- 4.1 Describing
- 4.2 Defining
- 4.3 Classifying
- 4.4 Providing examples or evidence
- 4.5 Writing introduction and conclusion.

#### 5. *Writing Practices*

- 5.1 Comprehension
- 5.2 Précis Writing

### 5.3 Essay Writing

### 5.4 Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

#### *Suggested Readings:*

- (i) *Practical English Usage*. Michael Swan. OUP. 1995.
- (ii) *Remedial English Grammar*. F.T. Wood. Macmillan.2007
- (iii) *On Writing Well*. William Zinsser. Harper Resource Book. 2001
- (iv) *Study Writing*. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (v) *Communication Skills*. Sanjay Kumar and PushpLata. Oxford University Press.2011.
- (vi) *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

#### *Course Outcomes*

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

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