CURRICULUM

FOR

MECHANICAL ENGINEERING

SEMESTER – I (MECHANICAL ENGINEERING)

S.No	Paper Code	Paper Title	L	T	P	Credits
1	102101	Physics (Electromagnetism)	3	1	3	5.5
2	102102	Mathematics –I (Calculus & Linear Algebra)	3	1	0	4
3	100101	Basic Electrical Engineering	3	1	2	5
4	100102	Engineering Graphics & Design	1	0	4	3

PAPER CODE – 102101

BSC	Physics (Electromagnetism)	L:3	T:1	P:3	Credit:5.5

Introduction To Electromagnetic Theory [L: 3; T: 1; P: 0 (4 Credits)]

Pre-Requisites: High-School Education

Detailed Contents:

Module 1

Electrostatics In Vacuum: Calculation Of Electric Field And Electrostatic
Potential For A Charge Distribution; Divergence And Curl Of Electrostatic Field;
Laplace's And Poisson's Equations For Electrostatic Potential And Uniqueness Of Their
Solution And Connection With Steady State Diffusion And Thermal Conduction; Practical
Examples Like Faraday's Cage And Coffee-Ring Effect; Boundary Conditions Of Electric
Field And Electrostatic Potential; Method Of Images; Energy Of A Charge Distribution And Its Expression In Terms Of Electric Field.

Module 2

Electrostatics In A Linear Dielectric Medium: Electrostatic Field And
Potential Of A Dipole. Bound Charges Due To Electric Polarization; Electric
Displacement; Boundary Conditions On Displacement; Solving
Simple Electrostatics Problems In Presence Of Dielectrics – Point Charge At The
Centre Of A Dielectric Sphere, Charge In Front Of A Dielectric Slab,
Dielectric Slab And Dielectric Sphere In Uniform Electric Field.

Module 3

Magnetostatics: Biot-Savart Law, Divergence And Curl Of Static Magnetic Field;
Vector Potential And Calculating It For A Given Magnetic Field Using
Stokes' Theorem; The Equation For The Vector Potential And Its
Solution For Given Current Densities.

Module 4

Magnetostatics In A Linear Magnetic Medium: Magnetization And Associated Bound
Currents; Auxiliary Magnetic Field; Boundary Conditions On And.
Solving For Magnetic
Field Due To Simple Magnets Like A Bar Magnet; Magnetic Susceptibility And
Ferromagnetic, Paramagnetic And Diamagnetic Materials; Qualitative
Discussion Of Magnetic Field In Presence Of Magnetic Materials.

Module 5

Faraday's Law: Faraday's Law In Terms Of Emf Produced By Changing Magnetic
Flux; Equivalence Of Faraday's Law And Motional Emf; Lenz's Law; Electromagnetic
Braking And Its Applications; Differential Form Of Faraday's Law Expressing Curl Of
Electric Field In Terms Of Time-Derivative Of Magnetic Field And
Calculating Electric Field Due To Changing Magnetic Fields In Quasi-Static Approximation; Energy Stored In A Magnetic Field.

Module 6

Displacement Current, Magnetic Field Due To Time-Dependent Electric Field And

Maxwell's Equations: Continuity Equation For Current Densities; Modifying Equation
For The Curl Of Magnetic Field To Satisfy Continuity Equation; Displace Current And
Magnetic Field Arising From Time- Dependent Electric Field; Calculating Magnetic
Field Due To Changing Electric Fields In Quasi- Static Approximation. Maxwell's
Equation In Vacuum And Non-Conducting Medium; Energy In An Electromagnetic Field;
Flow Of Energy And Poynting Vector With Examples. Qualitative Discussion Of Momentum In Electromagnetic Fields.

Module 7

Electromagnetic Waves: The Wave Equation; Plane Electromagnetic Waves In
Vacuum, Their Transverse Nature And Polarization; Relation Between Electric And
Magnetic Fields Of An Electromagnetic Wave; Energy Carried By Electromagnetic Waves And Examples. Momentum Carried By Electromagnetic Waves And Resultant Pressure.
Reflection And Transmission Of Electromagnetic Waves From A Non- Conducting Medium-Vacuum Interface For Normal Incidence.

Suggested Text Books:

➜ David Griffiths, Introduction To Electrodynamics

Suggested Reference Books:

➜ Halliday And Resnick, Physics
➜ W. Saslow, Electricity, Magnetism And Light

Laboratory - Introduction To Electromagnetic Theory [L:0;T:0;P:3 (1.5

Credits)] Choice Of Experiments From The Following:

➜ Experiments On Electromagnetic Induction And Electromagnetic Braking;
➜ Lc Circuit And Lcr Circuit;

- ➔ Resonance Phenomena In Lcr Circuits;
- ➔ Magnetic Field From Helmholtz Coil;
- ➔ Measurement Of Lorentz Force In A Vacuum Tube

PAPER CODE - 102102

BSC	Mathematics I (Calculus & Linear Algebra)	L:3	T:1	P:0	Credit:4

Detailed contents:

Module 1

Calculus: 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.

Module 2

Calculus: Rolle's Theorem, Mean Value Theorems, Tayor's And
Maclaurin's Theorems With Remainders; Indeterminate Forms And
L'hospital's Rule; Maxima And Minima.

Module 3

Sequences And Series: Convergence Of Sequence And Series, Tests
For
Convergence; Power Series, Taylor's Series, Series For Exponential,
Trigonometric And Logarithmic Functions; Fourier Series: Half Range
Sine And Cosine Theorem.

Module 4

Multivariable Calculus (Differentiation): 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.

Module 5

Matrices: 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:

- ➔ G.B. Thomas And R.L. Finney, Calculus And Analytic Geometry, 9th Edition, Pearson, Reprint, 2002.
- ➔ Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
- ➔ Veerarajan T., Engineering Mathematics For First Year, Tata Mcgraw-Hill, New Delhi, 2008.
- ➔ Ramana B.V., Higher Engineering Mathematics, Tata Mcgraw Hill New Delhi, 11th Reprint, 2010.
- ➔ D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
- ➔ N.P. Bali And Manish Goyal, A Textbook Of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
- ➔ B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th 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.

PAPER CODE - 100101

100101	Basic Electrical Engineering	L:3	T:1	P:2	Credit:5

Detailed Contents:

Module 1

Dc Circuits: Electrical Circuit Elements (R, L And C), Voltage And Current Sources, Kirchhoff Current And Voltage Laws, Analysis Of Simple Circuits With Dc
Excitation. Star-Delta Conversion, Network Theorems (Superposition, Thevenin, Norton And Maximum Power Transfer Theorems). Time-Domain Analysis Of First-Order Rl And Rc Circuits

Module 2

Ac Circuits: Representation Of Sinusoidal Waveforms, Peak, Rms And Average
Values (Form Factor And Peak Factor), Impedance Of Series And Parallel Circuit,
Phasor Representation, Real Power, Reactive Power, Apparent Power, Power Factor,
Power Triangle. 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

Magnetic Circuits: Introduction, Series And Parallel Magnetic Circuits, Analysis Of Series And Parallel Magnetic Circuits.

Module 4

Transformers: Magnetic Materials, Bh Characteristics, Ideal And Practical Transformer, Emf Equation, Equivalent Circuit, Losses In Transformers, Regulation And Efficiency. Auto-Transformer And Three-Phase Transformer Connections.

Module 5

Electrical Machines: Construction, Working, Torque-Speed Characteristic And Speed Control Of Separately Excited Dc Motor. 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. Construction And Working Of Synchronous Generators.

Module 6

Electrical Installations: 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.

Reference Books:

→ D. P. Kothari And I. J. Nagrath, "Basic Electrical Engineering", Tata Mcgraw Hill, 2010.

→ D. C. Kulshreshtha, "Basic Electrical Engineering", Mcgraw Hill, 2009.

→ L. S. Bobrow, "Fundamentals Of Electrical Engineering", Oxford University Press, 2011.

→ E. Hughes, "Electrical And Electronics Technology", Pearson, 2010.

→ V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

→ Basic Electrical Engineering By Fitzerald, Et Al, Tata Mcgraw Hill

→ Fundamentals Of Electrical Engg. By R. Prasad, Phi Publication

→ Basic Electrical Engineering By V.K. Mehta And Rohit Mehta, S.Chand Publication

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

Laboratory:

List Of Experiments:

➔ 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.
➔ Transformers: Observation Of The No-Load Current Waveform On An Oscilloscope (Non- Sinusoidal Wave-Shape Due To B-H Curve Nonlinearity Should Be Shown Along With A Discussion About Harmonics). Loading Of A Transformer: Measurement Of Primary And Secondary Voltages And Currents, And Power.
➔ Three-Phase Transformers: Star And Delta Connections. Voltage And Current Relationships (Line-Line Voltage, Phase-To-Neutral Voltage, Line And Phase Currents). Phase-Shifts Between The Primary And Secondary Side. Cumulative Three-Phase Power In Balanced Three-Phase Circuits.
➔ Demonstration Of Cut-Out Sections Of Machines: Dc Machine (Commutator-Brush Arrangement), Induction Machine (Squirrel Cage Rotor), Synchronous Machine (Field Winging - Slip Ring Arrangement) And Single-Phase Induction Machine. ➔ Torque Speed Characteristic Of Separately Excited Dc Motor.
➔ Demonstration Of Cut-Out Sections Of Machines: Dc Machine (Commutator-Brush

Arrangement), Induction Machine (Squirrel Cage Rotor),
Synchronous Machine (Field Winging - Slip Ring Arrangement) And
Single-Phase Induction Machine.
→ Torque Speed Characteristic Of Separately Excited Dc Motor.
→ Synchronous Speed Of Two And Four-Pole, Three-Phase Induction
  Motors.
  Direction Reversal By Change Of Phase-Sequence Of Connections.
  Torque-Slip
  Characteristic Of An Induction Motor. Generator Operation Of An
  Induction Machine Driven At Super- Synchronous Speed.
→ Synchronous Machine Operating As A Generator: Stand-Alone
  Operation With A Load. Control Of Voltage Through Field
  Excitation.
→ Demonstration Of (A) Dc-Dc Converters (B) Dc-Ac Converters – Pwm
  Waveform (C) The Use Of Dc-Ac Converter For Speed Control Of An
  Induction Motor And (D) Components Of Lt Switchgear.

Laboratory Outcomes:

→ Get An Exposure To Common Electrical Components And Their
  Ratings.
→ Make Electrical Connections By Wires Of Appropriate Ratings.
→ Understand The Usage Of Common Electrical Measuring Instruments.
→ Understand The Basic Characteristics Of Transformers And
  Electrical Machines.
→ Get An Exposure To The Working Of Power Electronic Converters

Paper Code - 100102

100102	Engineering Graphics & Design	L:1	T:0	P:4	Credit:3

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; Coordinate Systems; Multi-
View Projection;
Exploded Assembly; Model Viewing; Animation; Spatial Manipulation;
Surface Modelling; Solid Modelling, Introduction To Building
Information Modelling (Bim).

Module 1

Introduction To Engineering Drawing: 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

Module 2

Orthographic Projections: Principles Of Orthographic Projections- Conventions
-Projections Of Points And Lines Inclined To Both Planes; Projections Of Planes Inclined Planes -Auxiliary Planes

Module 3

Projections Of Regular Solids: 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.

Module 4

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)

Module 5

Isometric Projections: 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

Module 6

Overview Of Computer Graphics: 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]

Module 7

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.

Module 8:

Annotations, Layering & Other Functions: Covering 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.

Module 9

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).

Reference Books:

- ➔ Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
- ➔ Shah, M.B. & Rana B.C. (2008), Engineering Drawing And Computer Graphics, Pearson Education
- ➔ Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, Tmh Publication
- ➔ Narayana, K.L. & P Kannaiah (2008), Text Book On Engineering Drawing, Scitechpublishers
- ➔ (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, 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

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