



Subject Code: R16CC1102

I B.Tech I Semester Supple Examinations, May-2026

ENGINEERING MATHEMATICS

(Common to CE, EEE, ME, ECE & CSE)

Time: 3 hours

Max Marks: 60

Question Paper Consists of **Part-A** and **Part-B**.

Answering the question in **Part-A** is Compulsory & Four Questions should be answered from Part-B

All questions carry equal marks of 12.

PART-A

1. (a) State Newton's law of cooling.
(b) Solve $(D^2 + 1)y = 0$.
(c) Find the critical points of the function $f(x) = 5x^2 - 6x$.
(d) Find the value of $\frac{du}{dt}$ given $u = \log(x + y + z)$, $x = e^t$, $y = \sin t$, $z = \cos t$
(e) Find the partial differential equation from $z = ax + by + ab$.
(f) Write down the possible solutions of one dimensional heat flow equation.

[2+2+2+2+2+2]

PART-B

4X 12 = 48

2. (a) Solve $\frac{dy}{dx} = e^{x-y}(e^x - e^y)$.
(b) Solve $2xydy - (x^2 + y^2 + 1)dx = 0$.
3. (a) Solve $(D^2 + 3D + 2)y = \sin x + x^2$.
(b) Apply method of variation of parameter to solve $(D^2 + a^2)y = \sec(ax)$.
4. (a) Determine all the number(s) satisfy the conclusion of mean value theorem for the given function and interval $f(x) = 4x^3 - 8x^2 + 7x - 2$ on $[2, 5]$.
(b) Find the maxima and minima of the function $4x^3 + 3x^2 - 6x + 10$.
5. (a) Expand $e^x \log(1 + y)$ in powers of x and y up to the third degree using Taylor's theorem.
(b) Find the Jacobian of y_1, y_2, y_3 with respect to x_1, x_2, x_3 if $y_1 = \frac{x_2 x_3}{x_1}$, $y_2 = \frac{x_1 x_3}{2}$, $y_3 = \frac{x_1 x_2}{2}$.
6. (a) Solve $x(y - z)p + y(z - x)q = z(x - y)$.
(b) Find the partial differential equation of all planes which are at a constant 'a' from the origin.
7. (a) Find the particular integral of $(D^3 - 7DD'^2 - 6D'^3)z = \sin(2x + y)$.
(b) A tightly stretched string with fixed end points $x=0$ and $x=L$ is initially at rest in its equilibrium position. If it is set vibrating giving each point a velocity $f(x)$. Find the displacement.

All questions carry equal marks of 12.



Subject Code: R16CC1108

I B.Tech I Semester Supple Examinations, May-2026

ENGINEERING PHYSICS

(Common to ECE & CSE)

Time: 3 hours

Max Marks: 60

Question Paper Consists of **Part-A** and **Part-B**.

Answering the question in **Part-A** is Compulsory & Four Questions should be answered from Part-B

All questions carry equal marks of 12.

PART-A

1. (a) Write about Coherent Sources.
(b) Define the Acceptance angle.
(c) write about the Structures of SC, BCC, and FCC.
(d) what are the properties of Ultrasonic waves
(e) What are Matter waves
(f) what are the differences between conductors and insulators.

[2+2+2+2+2+2]

PART-B

4X 12 = 48

2. (a) write the construction of radius of curvature of plano convex lens
(b) Write the difference between Fresnel and Fraunhofer Diffraction
3. (a) Derive Einstein's coefficients
(b) Define Optical Fiber. Write the construction of optical fiber
4. (a) write about Primitive and non-primitive unit cell
(b) Define Bragg's law. Write the limitation of Bragg's Law of X-Ray diffraction
5. (a) write about Piezo electric effect
(b) what are the Basic requirements of acoustically good hall
6. (a) Write about Quantum free electron theory
(b) Write about De-Broglie's hypothesis
7. (a) Write about Kronig-Penny model
(b) write about Fermi level in intrinsic and extrinsic semiconductors.



Subject Code: R16CC1203

I B.Tech II Semester Supple Examinations, May-2026

**ENGINEERING PHYSICS
(Common to CE, EEE & ME)**

Time: 3 hours

Max Marks: 60

Question Paper Consists of **Part-A** and **Part-B**.

Answering the question in **Part-A** is Compulsory & Four Questions should be answered from Part-B

All questions carry equal marks of 12.

PART-A

1. (a) Define interference of light.
- (b) What is population inversion?
- (c) Define packing fraction.
- (d) Write piezoelectric effect.
- (e) Define mobility of electrons.
- (f) What is forbidden energy gap?

[2+2+2+2+2+2]

PART-B

4 X 12 = 48

2. (a) Explain the formation of interference fringes due to two coherent sources and derive the conditions for constructive and destructive interference. [6M]
- (b) Discuss the conditions necessary for obtaining a sustained interference pattern. [6M]
3. (a) Explain spontaneous emission and stimulated emission of radiation. [6M]
- (b) Explain the construction and working of Ruby laser with neat diagram. [6M]
4. (a) Define space lattice, basis, and unit cell. Explain primitive and non-primitive unit cells. [6M]
- (b) Explain the structure of Body Centered Cubic (BCC) crystal and derive its packing fraction. [6M]
5. (a) Explain the production of ultrasonic waves using piezoelectric method with neat diagram. [6M]
- (b) Discuss the applications of ultrasonic waves in medicine, industry, and navigation. [6M]
6. (a) Explain Fermi-Dirac distribution function and discuss its dependence on temperature. [6M]
- (b) Explain the classical free electron theory and derive the expression for electrical conductivity. [6M]
7. (a) Differentiate between conductors, semiconductors, and insulators based on energy band diagrams. [6M]
- (b) Define Hall effect and derive the expression for Hall coefficient. [6M]

Subject Code: R16CC1204**I B.Tech II Semester Supple Examinations, May-2026****ENGINEERING CHEMISTRY****(Common to ECE & CSE)****Time: 3 hours****Max Marks: 60**Question Paper Consists of **Part-A** and **Part-B**.Answering the question in **Part-A** is Compulsory & Four Questions should be answered from Part-B

All questions carry equal marks of 12.

PART-A

1. (a) Explain phosphate conditioning.
- (b) What is meant by vulcanization?
- (c) Explain lyotropic liquid crystals.
- (d) Discuss cladding.
- (e) Explain LPG.
- (f) Define fluorescence and phosphorescence.

[2+2+2+2+2+2]**PART-B****4 X 12 = 48**

2. (a) Discuss sludge and scales.
- (b) Explain the steps involved in treatment of municipal water.
3. (a) Explain preparation, properties and applications of Bakelite.
- (b) Discuss conducting polymers.
4. (a) Explain construction and working of photovoltaic cells.
- (b) Explain the twelve principles of green chemistry.
5. (a) Discuss the factors affecting rate of corrosion.
- (b) Discuss electrochemical series.
6. (a) Explain the working of bomb calorimeter.
- (b) Discuss Fischer's Tropch method for preparation of synthetic petrol.
7. (a) Discuss (i) Grothus-Draper law (ii) Lambert-Beer's Law
- (b) Explain applications of photochemistry

Subject Code: R16EC2104

II B.Tech I Semester Supply Examinations, May-2026

CONTROL SYSTEMS

(ECE)

Time: 3 hours

Max Marks: 60

Question Paper Consists of **Part-A** and **Part-B**.

Answering the question in **Part-A** is Compulsory & Four Questions should be answered from Part-B

All questions carry equal marks of 12.

PART-A

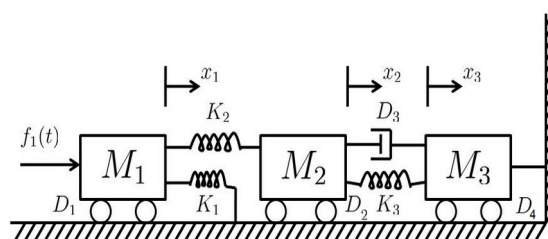
1. (a) What are the different types of control system?
- (b) What is the difference between AC servo motor and D.C servo motor?
- (c) What is the difference between type and order of a system?
- (d) What are the advantages of frequency domain analysis?
- (e) Define resonant peak and bandwidth
- (f) What is meant by Diagonalization?

[2+2+2+2+2+2]

PART-B

4 X 12 = 48

2. (a) Contrast differences between open loop and closed loop control systems.[6M]
- (b) Develop the differential equations governing the mechanical system as shown in below figure. Also find the transfer function $\frac{x_1(s)}{F(s)}$. [6M]



3. (a) Describe the construction and operating principle of synchro transmitter with neat diagrams.[12M]
4. (a) Explain the effect of Proportional plus Derivative Control (PD) action on the performance of a second order system. [6M]
- (b) Determine the step, ramp and parabolic error constants of the following unity feedback control system whose open loop transfer function is given by

$$G(s) = \frac{500}{(1+5s)(1+10s)}$$
 [6M]
5. (a) Using Routh-Hurwitz criterion, determine the stability of the closed loop system that has the following characteristic equation and also determine the number of roots that are in the right half s-plane and on the imaginary axis $s^4+s^3+3s^2+2s+5$ [6M]
- (b) Find the angles of departure and arrival for all complex poles and zeros of the open loop transfer function of $G(s)H(s) = \frac{K(s^2+3s+5)}{s(s^2+4)}$ $K>0$. [6M]

6. (a) Construct Bode plot for the system whose open loop transfer function is given below [6M]
and determine (i) the gain margin (ii) the phase margin and (iii) the closed loop stability

$$G(s)H(s) = \frac{4}{s(1+0.5s)(1+0.08s)}$$

- (b) Find resonant peak, resonant frequency and bandwidth of the unity feedback system [6M]

whose open loop transfer function is as follows: $G(s) = \frac{0.5}{s^2 + 3s + 2}$

7. (a) The state variable formulation of a system is given by [12M]

$$\begin{bmatrix} \dot{x} \end{bmatrix} = \begin{bmatrix} -3 & 2 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} x \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \text{ and } y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x \end{bmatrix}.$$

Find the following: a) Transfer function of the system b) State transition matrix and c) State equation for a unit step input under zero initial condition.

Subject Code: R16ME2105**II B.Tech I Semester Supple Examinations, May-2026****THERMODYNAMICS****(ME)****Time: 3 hours****Max Marks: 60**Question Paper Consists of **Part-A** and **Part-B**.Answering the question in **Part-A** is Compulsory & Four Questions should be answered from Part-B

All questions carry equal marks of 12.

PART-A

1. (a) What is thermodynamic equilibrium?
- (b) Define enthalpy.
- (c) Define thermal energy
- (d) What is dryness fraction?
- (e) What is entropy of gas mixture?
- (f) Define COP of refrigerator.

[2+2+2+2+2+2]**PART-B****4 X 12 = 48**

2. (a) Describe macroscopic and microscopic approaches in thermodynamics.
 - (b) Explain thermodynamic system, surroundings and boundary with neat sketches.
3. Explain about turbine, compressor and nozzle with neat sketches
4. (a) Derive Clausius inequality and explain entropy principle.
 - (b) Write a brief note on Maxwell relations. Mention its uses.
5. Steam flow in a pipe line at 1.5Mpa. After expanding to 0.1Mpa in throttling calorimeter, the temperature is found to be 120°C. Find the quality of steam in the pipeline. What is the maximum moisture at 1.5Mpa that can be determined with this set up if at least 5°C of super heat is required after throttling for accurate readings?
6. (a) Explain Dalton's law of partial pressures and Avogadro's law.
 - (b) Explain gravimetric and volumetric analysis of gas mixtures.
7. Explain the working of Vapour Compression Refrigeration system with a neat sketch.



Subject Code: R16ME3102

III B.Tech I Semester Supple Examinations, May-2026

HEAT POWER ENGINEERING

(ME)

Time: 3 hours

Max Marks: 60

Question Paper Consists of **Part-A** and **Part-B**.

Answering the question in **Part-A** is Compulsory & Four Questions should be answered from Part-B

All questions carry equal marks of 12.

PART-A

- (a) List the commonly used solid, liquid and gaseous fuels.
- (b) Classify boilers and give examples.
- (c) Define critical pressure ratio.
- (d) What is meant by velocity compounding?
- (e) List different methods for steam flow measurement.
- (f) Write short notes on types of combustion chambers.

[2+2+2+2+2+2]

PART-B

4 X 12 = 48

- 1. Explain the methods used to improve the performance of the Rankine cycle. How do **reheating** and **regeneration** affect the cycle's efficiency and output?
- 2. How are boilers classified? Explain the working principle of a **Babcock and Wilcox boiler** with a neat sketch.
- 4. Derive an expression for the velocity of steam at the exit of a nozzle. State the assumptions made.
- 5. What is **compounding** in steam turbines? Explain the principles of pressure compounding and velocity compounding with sketches.
- 6. (a) Explain the working of a **natural draught cooling tower** with a neat sketch.
(b) Explain the working of jet and surface condensers with diagrams.
- 7. Explain the working of a simple gas turbine plant with neat sketch and derive expressions for efficiency.

Subject Code: R16ME4202**IV B.Tech II Semester Supple Examinations, May-2026****REFRIGERATION & AIR CONDITIONING****(ME)****Time: 3 hours****Max Marks: 60**Question Paper Consists of **Part-A** and **Part-B**.Answering the question in **Part-A** is Compulsory & Four Questions should be answered from Part-B

All questions carry equal marks of 12.

PART-A

1. (a) Write the difference between refrigeration and air conditioning
- (b) List the components of VCR system
- (c) Summarize the functions of expansion valve used in refrigeration
- (d) Define boiling point of a refrigerant
- (e) Sketch the summer air conditioning system
- (f) Explain functions of dehumidifier

[2+2+2+2+2+2]**PART-B****4 X 12 = 48**

2. (a) Define Refrigeration and what is the necessity of refrigeration and write practical Applications of refrigeration.
(b) Explain the following systems with neat sketch. (i) Boot-strap air cooling system. (ii) Boot-strap air evaporative cooling system.
3. (a) Derive an expression for COP of vapour compression cycle from T-S chart when the refrigerant is dry saturated before compression.
(b) A refrigerator using Ammonia works between the temperatures -10°C and 25°C . The gas is dry at the end of compression and there is no under cooling of liquid. Using the tables, Calculate the theoretical COP of the cycle
4. (a) Write short notes on condensers and evaporators used for refrigeration industry.
(b) Write short notes on global warming with reference to refrigeration systems
5. (a) What is an absorption system? How does it differ from vapour compression system?
(b) Explain with a neat sketch the working of lithium-bromide vapour absorption system.
6. (a) How do you measure DBT, WBT and DPT and also explain when these three becomes equal?
(b) 100 m^3 of atmospheric air at 25°C DBT and 12°C WBT is flowing per minute through the duct. Dry-saturated steam at 100°C is injected into the air steam with a rate of 1.2 kg/min . calculate the temperature of air after mixing the steam. Take atmospheric pressure of 1.033 bar .
7. (a) Define a filter and its use and types
(b) Explain the different types of air distribution system

Subject Code: R16ME4206

IV B.Tech II Semester Supple Examinations, May-2026
ALTERNATE SOURCES OF ENERGY
(ME)

Time: 3 hours

Max Marks: 60

Question Paper Consists of **Part-A** and **Part-B**.

Answering the question in **Part-A** is Compulsory & Four Questions should be answered from Part-B
All questions carry equal marks of 12.

PART-A

1. (a) What is solar constant.
- (b) Differentiate between flat plate and concentrating solar collectors.
- (c) What is the purpose of solar pond.
- (d) What is anemometer.
- (e) Differentiate between anaerobic and aerobic digestion.
- (f) Explain the advantages of geothermal energy.

[2+2+2+2+2+2]

PART-B

4 X 12 = 48

2. How is solar radiation measured? Explain the working principle of a pyranometer, a pyrheliometer, and a sunshine recorder.
3. Classify and briefly describe different types of concentrating collectors
4. Explain in detail about different methods of solar energy storage.
5. (a) Derive the expression for power developed by a wind turbine.
(b) Explain Betz's limit and its significance.
6. Describe the types of bio-gas digesters – fixed dome and floating drum types.
7. Describe the methods used to harness geothermal energy and explain.
