

R16

I BTECH TO IV BTECH
END EXAMINATION QUESTION PAPERS
SUPPLEMENTARY
SEPT/OCT. 2025



Subject Code: R16CC1102

I B.Tech I Semester Supple Examinations, September-2025

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) Solve $(D^2+1)y=0$
- (b) Solve $\left(\frac{dy}{dx}+1\right)=e^x$.
- (c) Evaluate $\lim_{x \rightarrow 0} \frac{\log x}{\cot x}$.
- (d) If $u = \frac{x}{y+z} + \frac{y}{z+x} + \frac{z}{x+y}$, find the value of $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z}$
- (e) Form the partial differential equation by eliminating the arbitrary constants a and b from $z = ax + by + a^2 + b^2$.
- (f) Write wave equation and one dimensional heat flow equation.

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

PART-B

4X 12 = 48

2. (a) Solve the equation $(dy/dx)-(y/x)=5x^2y^5$
- (b) Radium decomposes at a rate proportional to the amount present. If a fraction p of original amount disappears in 1 year, how much will remain at the end of 21 years?
3. (a) Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} + 2y = e^x$
- (b) Solve $(d^3y/dx^3)+(d^2y/dx^2)-2(dy/dx)=0$
4. (a) If $f(x)=\sin x$, using Maclaurin's theorem expand $f(x)$
- (b) Prove that $x \sin x + \cos x + \frac{1}{2} \cos^2 x$ is strictly increasing in $\left(0, \frac{\pi}{2}\right)$
5. (a) If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$, prove that $\frac{1}{2} \frac{\partial u}{\partial x} + \frac{1}{3} \frac{\partial u}{\partial y} + \frac{1}{4} \frac{\partial u}{\partial z} = 0$.
- (b) Find the maximum value of $f(x,y) = x^2 + y^2$

6. (a) Form the partial differential equation by eliminating arbitrary functions from $f(x^2 + y^2, z - xy) = 0$.

(b) Find the general solution of $x(y^2 - z^2)p + y(z^2 - x^2)q = z(x^2 - y^2)$.

7. (a) Solve $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} = \cos x \cos 2y$.

(b) Using the method of separation of variables, solve $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0$.



Narasaraopeta Engineering College (Autonomous)

Kotappakonda Road, Yellamanda (P.O), Narasaraopet- 522601, Guntur District, AP.

Subject Code: R16CC1103

I B.Tech I Semester Supple Examinations, September-2025

MATHEMATICAL METHODS
(Common to CE, EEE, ME & 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) In LU decomposition, if $A=LU$, specify the structure of L and U .
(b) If the eigen values of A are 2 and -3, find the eigen values of A^{-1} and A^5 .
(c) Evaluate $\int_0^1 \int_0^2 xy \, dx \, dy$.
(d) What is the condition on $f(a)$ and $f(b)$ for applying bisection method.
(e) State Newton's divided difference interpolation formula.
(f) Write the condition on the number of sub-intervals in Simpson's $\frac{1}{3}$ rule, and write its general formula.

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

PART-B

4X 12 = 48

2. (a) Solve the following system of equations by Gauss Seidel method

$$10x + 2y + z = 9; x + 10y - z = -22; -2x + 3y + 10z = 22.$$

- (b) Apply Gauss elimination method to solve the system

$$2x + 3y - z = 5; 4x + 4y - 3z = 3; 2x - 3y + 2z = 2.$$

3. (a) Using Cayley Hamilton theorem find A^{-1} when $A = \begin{bmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$.

- (b) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$.

4. (a) Change the order of integration and hence evaluate $\int_1^3 \int_0^{\frac{6}{x}} x^2 \, dy \, dx$.

- (b) Using triple integration, find the volume of the sphere $x^2 + y^2 + z^2 = 9$.

5. (a) Find an iterative formula to find the reciprocal of a given number N and hence find the value of $\frac{1}{23}$.

(b) Solve by secant method for the equation $x^3 - 5x + 1 = 0$, in which the real roots lies in the interval (0,1).

6. (a) Using Lagrange's interpolation calculate the profit in the year 2023 from the following data

Year	2021	2022	2024	2025
Profit in lakhs	43	65	159	248

(b) Find the cubic polynomial which takes the following values

x	0	1	2	3
$F(x)$	1	2	1	10

And hence find the value of $F(1.5)$.

7. (a) Apply modified Euler's method to find $y(4.1)$ and $y(4.2)$ if $5x \frac{dy}{dx} + y^2 - 2 = 0$; $y(4) = 1$.

(b) Use Runge - Kutta method of fourth order to find $y(0.2)$ given $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, $y(0) = 1$, taking $h = 0.2$.



Narasaraopeta Engineering College (Autonomous)

Kotappakonda Road, Yellamanda (P.O), Narasaraopet- 522601, Guntur District, AP.

Subject Code: R16CC1104

I B.Tech I Semester Supple Examinations, September-2025

PROGRAMMING WITH C (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 algorithm and flowchart
- (b) Write the syntax of Do While statement
- (c) Define Recursion
- (d) What is the purpose of command line arguments?
- (e) What is bit field?
- (f) Write the purpose of feof() and rewind()

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

PART-B

4X 12 = 48

2. (a) Explain the structure of a C program
- (b) Explain the different types of data types in C programming
3. (a) Explain about switch statement. What is the importance of break and continue in switch statement?
- (b) Write a C program to print all the prime numbers between 1 to 100.
4. (a) Compare and Contrast call by value and call by reference with sample code
- (b) Explain the storage classes in C
5. (a) How to initialize and access pointer variable? Explain pointer to a function with example
- (b) What is dynamic memory management? Explain different dynamic memory management functions available in C language.
6. (a) How to pass structure variable to functions? Explain with example
- (b) Compare and Contrast structures and Unions
7. (a) List and explain various file functions available in C.
- (b) Write a C program to create a text file and read the text from the created file and count the number of vowels and consonants present in the file.



Subject Code: R16CC1105

I B.Tech I Semester Supple Examinations, September-2025

ENGINEERING CHEMISTRY

(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 sludge and scale with examples.
- (b) Explain vulcanization.
- (c) Define setting and hardening of cement.
- (d) Explain effects of corrosion.
- (e) What is refining of petrol.
- (f) What is photo sensitization.

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

PART-B

4X 12 = 48

2. (a) Explain Zeolite process of softing water. (6+6)
- (b) Explain Electro dialysis with a neat diagram.
3. (a) Explain the mechanism of Free radical polymerization (6+6)
- (b) Explain the synthesis, properties and applications of Bakelite.
4. (a) Explain the synthesis of Ibuprofen (4+4+4)
- (b) Explain properties and applications of CNT.
- (c) Explain the application of Green chemistry.
5. (a) Explain Lead-acid battery with a neat diagram. (7+5)
- (b) Explain Calomel Electrode.
6. (a) Explain Proximate analysis of coal. (6+6)
- (b) Explain synthesis of synthetic petrol by Fischer Trophs process.
7. (a) Explain Lambert-Beer Law. (7+5)
- (b) Explain calorimetric analysis.



Subject Code: R16CC1107

I B.Tech I Semester Supple Examinations, September-2025

ENGINEERING GRAPHICS

(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) What is a scale in engineering graphics?
(b) What is the purpose of the reference line XY in projections?
(c) What are the traces of a line?
(d) What is the difference between horizontal and vertical planes in engineering drawing?
(e) What are the differences between prisms and pyramids
(f) Define isometric projection.

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

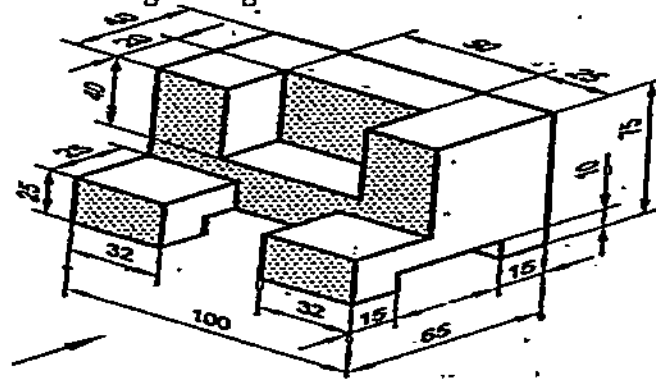
PART-B

4X 12 = 48

2. An automobile is running at a speed of 50 kmph. Construct a plain scale to read the minimum of a kilometer and a minute. The scale should measure up to a maximum of 60 km. The RF of the scale is $1/500000$. Show the distance covered by the automobile in 42 min on the scale.
3. (a) Draw the projections of the following points on the same ground line, keeping the Projectors 20mm apart.
i) A point A is 25 mm above the HP and 30 mm in front of the VP. Draw its Projections
ii) A point B is 20 mm below the HP and 40 mm behind the VP. Draw its Projections.
(b) The top view of a 75 mm long line CD measures 50 mm. C is 50mm in front of the V.P. and 15 mm below the H.P. D is 15 mm in front of the V.P. and is above the H.P. Draw the front view of CD and find its inclinations with the H.P. and the V.P.
4. A line PQ is in the first quadrant. Its ends P and Q are 20 mm and 60 mm in front of the VP respectively. The distance between the end projectors is 75 mm. The line is inclined at 30° to the VP, with its end in HP. Draw the projections of PQ and find its true length and the inclination with the HP. Also locate its HT.
5. A semicircular plate with an 80 mm diameter has its straight edge in the V.P. and inclined at 45° to the H.P. Draw the projections of the plate when its surface is inclined at 30° to the V.P.
6. A cone, diameter of base 50 mm and axis 50 mm long is resting on its base on the H. P. It is cut by a section plane perpendicular to the V.P., inclined at 75° to the H.P. and passing through the apex. Draw its front view, sectional top view and true shape of the section.

7.

Draw the front view and top view if the given figure.





Subject Code: R16CC1202

I B.Tech II Semester Supple Examinations, September-2025

INTEGRAL TRANSFORMS AND VECTOR CALCULUS

(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) Find the Laplace Transform of t^n , where n is a positive constant.
- (b) State the Convolution theorem for Laplace Transform.
- (c) State and Prove the Initial value theorem for Z transform.
- (d) Define Z-transform and using the definition find $Z\{n\}$.
- (e) Write the Dirichlet's conditions.
- (f) If $\vec{\phi}$ satisfies Laplacian equation then prove that it is both solenoidal and an irrotational.

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

PART-B

4 X 12 = 48

2. (a) Find the Laplace transform of $L\{t^2 \sin 3t\}$
- (b) Using Convolution theorem, find $L^{-1}\left(\frac{\cos bt - \cos at}{t^2}\right)$
3. (a) State and Prove final value theorem for Z-transform.
- (b) Solve the difference equation, using Z-transform; $u_{n+2} - 3u_{n+1} + 2u_n = 0$
given that $u_0 = 0, u_1 = 1$.
4. (a) Find the Fourier series expansion of $f(x) = \sin^2 x$ on $[0, 2\pi]$
- (b) Find the half range cosine series for $f(x) = x^2$ on $[0, l]$
5. (a) Find the Fourier Sine transform of $f(x) = x$ in $(0, 2)$
- (b) Find the Inverse Fourier Cosine transform of $f(x) = \frac{b^{-ax}}{cx}$, where $a > 0$.
6. (a) If $a = x + y + z, b = x^2 + y^2 + z^2$ and $c = xy + yz + zx$ then find $[\text{grad } a \text{ grad } b \text{ grad } c]$
- (b) If $\vec{f} = (y + z)\vec{i} + (z + x)\vec{j} + (x + y)\vec{k}$ then prove that $\vec{f}$ is an irrotational and then find its scalar potential function.
7. (a) If $\vec{f} = (x^2 - y^2)\vec{i} + 2xy\vec{j}$ and $\vec{r}$ is a position vector in xy -plane, find the value of $\oint \vec{f} \cdot d\vec{r}$ around the rectangle boundary $x=0, x=a, y=0$ and $y=b$.
- (b) Verify Gauss's Divergence theorem for $\iiint_S (x dy dz + y dz dx + z dx dy)$ where S is the surface of the sphere $x^2 + y^2 + z^2 = 1$.

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Subject Code: R16CC1203

I B.Tech II Semester Supple Examinations, September-2025

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) What is polarization of light? Name two types of polarized light.
(b) Explain the principle of optical fiber. How does light propagate through an optical fiber?
(c) What is the packing fraction of a crystal? Write the packing fraction for a Simple Cubic (SC) lattice.
(d) Write any two applications of ultrasonic wave.
(e) Define the mobility of charge carriers in a semiconductor.
(f) What is the energy band gap of a solid? Write the typical band gap values for conductors, semiconductors, and insulators.

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

PART-B

4 X 12 = 48

2. (a) What are coherent sources? State the conditions for sustained interference and explain the formation of Newton's rings [4]
(b) Distinguish between Fresnel and Fraunhofer diffraction. [4]
(c) What are Quarter-wave plate and Half-wave plate? [4]
3. (a) What are the characteristics of laser light? [4]
(b) Explain the processes of spontaneous and stimulated emission of radiation [4]
(c) Derive an expression for acceptance angle and numerical aperture. [4]
4. (a) Define a space lattice, basis, unit cell, and lattice parameters. Explain the seven crystal systems. [6]
(b) What are Miller indices? Describe the procedure for determining Miller indices of a crystal plane by taking an example with a neat diagram [6]
5. (a) Explain the production of ultrasonic waves using Piezo electric method [8]
(b) Write the applications of ultrasonic waves [4]
6. (a) Discuss the temperature dependence of the Fermi-Dirac distribution. How does the distribution change from absolute zero to higher temperatures? Illustrate with a neat graph [6]
(b) State de Broglie's hypothesis and derive the expression for de Broglie wavelength. Write any two important properties of matter waves. [6]
7. (a) Explain the Hall effect. Derive an expression for the Hall coefficient? [6]
(b) A semiconductor sample carrying a current of 5 mA is placed in a magnetic field of 0.5 T. The thickness of the sample is 1 mm and the measured Hall voltage is 20 μ V. Calculate the concentration of charge carriers. [6]

Subject Code: R16CC1206

I B.Tech II Semester Supple Examinations, September-2025

ENGINEERING MECHANICS

(Common to CE & 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) State fundamental principles of mechanics.
- (b) Define the laws of friction.
- (c) List the Pappus – I and Pappus – II theorem statements.
- (d) Enumerate Parallel and Perpendicular Axis theorem.
- (e) Justify the importance of Mass Moment of Inertia in Engineering Applications.
- (f) Enumerate Newton's Laws of Motion.

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

PART-B

4 X 12 = 48

2. A beam ABCDE hinged at A and supported on rollers at D, is loaded as shown in Fig.1. Find the reactions at A and D

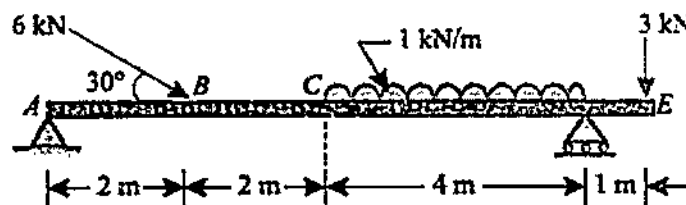


Fig. 1

3. Two blocks W_1 and W_2 resting on two inclined planes are connected by a horizontal bar AB as shown in Fig.2. If W_1 is equals 1000 N, determine the maximum value of W_2 for which the equilibrium can exists. The angle of limiting friction is 12° at all rubbing faces.

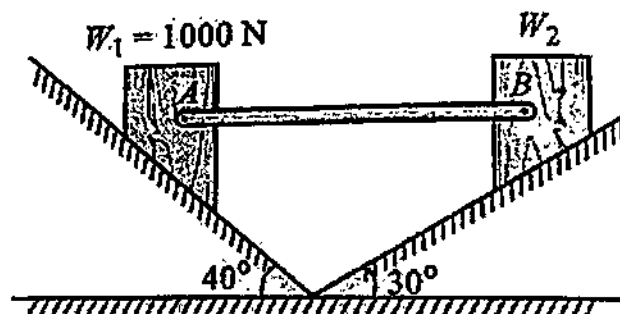


Fig. 2

4. A uniform lamina shown in Fig. 3 consists of a rectangle, a circle and a triangle. Determine the centre of gravity of the lamina. All dimensions are in mm

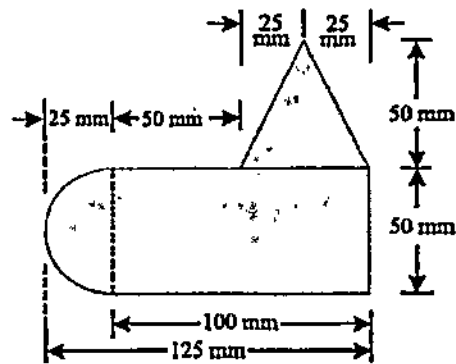


Fig.3

5. Find the moment of inertia of a T-section with flange as 150 mm × 50 mm and web as 150 mm × 50 mm about X-X and Y-Y axes through the centre of gravity of the section as shown in Fig. 4

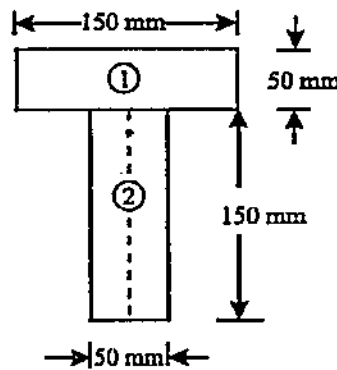


Fig. 4

6. Determine the Mass Moment Inertia for the Cylinder of length 'L' and Diameter 'D'. What's the change in value if length is doubled and diameter was reduced by one-third of their dimensions respectively?
7. (a) A ball of mass 0.3 kg is thrown with an initial speed of 17.6 m/s from level ground and finally hits the ground with a speed of 9.50 m/s. Find the net work done on the ball.
- (b) A wedge of mass 2.80 kg starts from rest and slides down a 46° ramp and reaches the bottom of the ramp with a speed of 3.40 m/s. Determine the total work on the wedge.



Narasaraopeta Engineering College (Autonomous)

Kotappakonda Road, Yellamanda (P.O), Narasaraopet- 522601, Guntur District, AP.

Subject Code: R16ME2105

II B.Tech I Semester Supplementary Examinations, Oct-2025.

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) Define zeroth law of thermodynamics?
(b) What is Enthalpy?
(c) Define Exergy and Irreversibility.
(d) What is a pure substance and what do you understand by saturation states
(e) Define Volume fraction and partial pressure.
(f) Draw p-v and T-s diagram of Dual cycle?

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

PART-B

4 X 12 = 48

2. (a) Define thermal equilibrium? And explain the construction of temperature scales. [6 M]
(b) An engine cylinder has a piston of area 0.12 m^2 and contains at a pressure of 1.5 MPa. The gas expands according to a process which is represented by a straight line on a pressure -volume diagram. The final pressure is 0.15 MPa. Calculate the work done by the gas on the piston if the stroke is 0.30 m. [6 M]
3. (a) Explain the first law for a closed system undergoing a cycle and show that energy is a property of a system. [6 M]
(b) 425 kJ of heat is supplied to a system at constant volume. System rejects 465 kJ of heat at constant pressure and 150 J of work is done on it. The system is brought to an initial state by an adiabatic work. Calculate the values of internal energy at all state points. Take initial value as 500 J. [6 M]
4. (a) Establish the equivalence of Kelvin-Planck and Clausius statements. [6 M]
(b) A refrigeration plant for a food store operates with a COP which is 40% of the ideal COP of a Carnot refrigerator. The store is to be maintained at a temperature of -5°C and the heat transfer from the store to the cycle is at the rate of 5 kW. If the heat is transferred from the cycle to the atmosphere at a temperature of 25°C , calculate the power required to drive the plant and the heat discharged to the atmosphere. [6 M]
5. (a) Draw the phase equilibrium diagram for a pure substance on P-V, T-S and h-s plots with relevant constant property lines [6 M]
(b) Ten kg of water at 55°C is heated at a constant pressure of 15 bar until it becomes superheated vapour at 300°C . Find the change in volume, enthalpy, internal energy and entropy. [6 M]

6. (a) Write a short note on

(i) Mass fraction

(ii) Dalton's law of partial pressures

[6 M]

(b) A constant volume chamber of 0.3 m^3 capacity contains 1 kg of air at 8°C . Heat is transferred to the air until the temperature is 150°C . Find the work done, the heat transferred and the changes in the internal energy, enthalpy and entropy.

[6 M]

7. (a) Explain the working of Otto cycle and derive the expression for thermal efficiency. [6 M]

(b) In an air standard Diesel cycle the compression ratio is 16 and at the beginning of isentropic compression, the temperature is 15°C and the pressure is 0.1 MPa. Heat is added until the temperature at the end of constant pressure process is 1480°C . Calculate (i) Cut-off ratio (ii) the heat supplied per kg of air (iii) the cycle efficiency.

[6 M]



Narasaraopeta Engineering College (Autonomous)

Kotappakonda Road, Yellamanda (P.O), Narasaraopet- 522601, Guntur District, AP.

Subject Code: R16EC2104

II B.Tech I Semester Supple Examinations, October-2025

CONTROL SYSTEMS

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 analogous systems? Give an example.
(b) What is the importance of block diagram reduction in control systems?
(c) Define the term 'steady state error.'
(d) How do poles and zeros affect the root locus plot?
(e) Define resonant frequency in frequency response analysis.
(f) What is meant by diagonalization in state space analysis?

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

PART-B

4 X 12 = 48

2. (a) Compare open loop and closed loop control systems [6M]
(b) Discuss the effects of feedback on gain, stability, and sensitivity of a control system. [6M]
3. (a) Describe the signal flow graph (SFG) representation. How does it differ from block diagram representation? [4M]
(b) Derive the transfer function of an AC servomotor and explain its working principle. [8M]
4. (a) Analyse the transient response of a second-order system for a unit ramp input. [6M]
(b) For a second-order system, derive the expressions for rise time, settling time, and peak overshoot for a unit step input. [6M]
5. (a) Discuss the concept of conditional stability and its significance in control systems. [4M]
(b) List the rules in construction of root locus [8M]
6. (a) Determine the phase margin and gain margin from the Nyquist plot of the system with open-loop transfer function $G(s)H(s)$. [6M]
$$G(s)H(s) = \frac{5}{s(1+s)(1+2s)}$$

(b) Using the Routh-Hurwitz criterion, analyse the stability of the closed-loop system with the characteristic equation $s^4 + s^3 + 3s^2 + 2s + 5 = 0$. Also, determine the number of roots in the right half-plane and on the imaginary axis. [6M]
7. Write a short notes on state vector, state-space, Controllability and Observability [12M]

Subject Code: R16CE3101

III B.Tech I Semester Supple Examinations, October-2025

STRUCTURAL ANALYSIS-II

(CE)

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) In the consistent deformation (force) method, what is meant by the term "redundant"?
- (b) State Castigliano's second theorem and mention one application in structural analysis.
- (c) Write the general form of Clapeyron's three-moment equation for three consecutive supports.
- (d) In slope deflection equations, what do the terms θ_A and θ_B represent for a beam AB?
- (e) Define Distribution Factor (DF). How is it related to member stiffness?
- (f) What is the purpose of introducing the rotation factor in Kani's method?

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

PART-B

4 X 12 = 48

2. A propped cantilever beam of span 6 m is fixed at A and supported by a prop at B. The beam carries a uniformly distributed load of 20.5 kN/m over the entire span. Using the **consistent deformation method**, determine the support reactions and the fixed end moment at A. Draw the bending moment diagram.
3. A continuous beam ABC has two spans of 5 m and 6.5 m respectively. Span AB carries a UDL of 10.5 kN/m, and span BC carries a central point load of 20.6 kN. Using the **strain energy method**, determine the redundant reaction at support B and draw the bending moment diagram.
4. A continuous beam ABC has spans AB = 6.5 m, BC = 4.5 m. Span AB carries a UDL of 15.66 kN/m, and span BC carries a point load of 25.33 kN at midspan. Using **Clapeyron's theorem of three moments**, calculate the support moments at A, B, and C.
5. Analyze the continuous beam ABC (span AB = 6.3 m, span BC = 6.5 m) fixed at A and C, with a central point load of 40 kN on span AB and a UDL of 3.5 kN/m on span BC. Using the **slope deflection method**, determine the end moments and support reactions. Draw the bending moment diagram.
6. A continuous beam ABC has two spans, AB = 5 m, BC = 4 m. The beam is fixed at A and simply supported at C. Span AB carries a UDL of 12 kN/m, while span BC carries a point load 20.33 kN at midspan. Using the **moment distribution method**, determine the support moments and draw the bending moment diagram.
7. A single-bay, single-storey portal frame has columns AB and CD each 4 m high, and beam BC of span 6 m. The supports at A and D are fixed. The beam BC carries a UDL of 15 kN/m, and a horizontal force of 20 kN acts at joint B. Analyze the frame for sway using the **moment distribution method or Kani's method**, and determine the joint moments.



Subject Code: R16ME3102

III B.Tech I Semester Supple Examinations, Oct-2025

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

1. (a) What is adiabatic flame temperature
(b) Write few advantages of water level indicator
(c) What is choked flow through nozzle
(d) What is the necessity of compounding of a steam turbine.
(e) List the applications of cooling towers
(f) Draw schematics of open and closed gas turbine plants

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

PART-B

4 X 12 = 48

2. A steam turbine plant operates on Rankine cycle with steam entering turbine at 50 bar, 450°C and leaving at 0.05 bar. Steam leaving turbine condenses to saturated liquid inside condenser. Feed pump pumps saturated liquid into boiler. Determine the network per kg of steam and the cycle efficiency assuming all processes to be ideal. Also show cycle on T-s diagram. Also determine pump work per kg of steam considering linear variation of specific volume.
3. (a) Explain with neat sketches the construction and working of any one of the following high pressure boilers? (i) Loeffler boiler (ii) Benson boiler.
(b) Explain the working of super heater and economiser with neat sketch
4. Air is expanded reversibly and adiabatically in a nozzle from 13 bar and 150°C to a pressure of 6 bar. The inlet velocity of the nozzle is very small, and the process occurs under steady flow conditions. Calculate the exit velocity of the nozzle.
5. In a single row impulse turbine the nozzle angle is 35° and the blade speed is 320 m/s. The steam speed is 540 m/s. The blade friction coefficient is 0.94. Assuming axial exit and a flow rate of 815 kg/hr, determine:
(i) Blade angles,
(ii) Absolute velocity of steam at exit, and (iii) The power output of the turbine.
6. (a) Explain the working of pollution testing instruments used in power plants.
(b) What are the reasons for instrumentation of steam power plant? Explain.
7. gas-turbine power plant operates on the simple Brayton cycle with a pressure ratio of 8. The maximum and minimum temperatures of the cycle are 1000 K and 388 K respectively. Assuming an ideal cycle, calculate the efficiency and specific work output of the plant.

Subject Code: R16CE3201

III B.Tech II Semester Supple Examinations, September-2025
DESIGN AND DRAWING OF STEEL STRUCTURES
(CE)

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.

Use of IS: 800 is permitted.

Assume any Suitable Data

PART-A

1. (a) Differentiate between Lap Joint and Butt Joint.
(b) Define the following (i)laterally supported beams (ii)laterally unsupported beams
(c) Explain about Effective Length and Slenderness Ratio.
(d) What do you mean by a Built-up Column?
(e) Differentiate between Slab Base and Gusset Base.
(f) What is a Column-Splice and Explain about Splicing?

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

PART-B

4 X 12 = 48

2. (a) An ISA 55x55x8 carries a tensile load of 200 kN, applied along its centroidal axis. This angle is to be welded to a gusset plate. Find out the lengths of side fillet welds required at the heel and toe of the angle.
3. (a) A simply supported steel joist of 4.0m effective span is laterally supported throughout. It carries a total uniformly distributed load of 35kN/m (inclusive of self-weight). Design an appropriate I-section.
4. (a) Design a double angle discontinuous strut to carry a load of 100KN. The length of the Strut is 3.0m between intersections. The two angles are placed back to back with longer legs connected to a gusset plate of 12mm thick.
5. (a) Design a built-up column of effective length 6 m. It is subjected to a factored axial compressive load of 2500 kN. Provide two channels back to back connected with battens by site welded connection.
6. (a) Design a gusseted base system and connecting elements to carry column axial load of 800 kN (Column section ISHB 400). Assume M30 grade concrete used in foundation. Design and detail the system with necessary checks.
7. (a) Design a gantry girder (without lateral restraint along its span) for an Industrial building to support overhead travelling crane. Use the following data: Centre to centre distance between column (span of gantry) 6 m, Crane capacity 150 kN, Self weight of crane girder (exclude trolley) 160 kN, Self weight of trolley motor and other accessories 40 kN, Minimum hook approach 1.00 m, Distance between wheel centers of trolley 2.00 m, Centre to centre between gantry rails (span of crane) 12 m, Self weight of rail section 250 N/m, Yield strength of steel 250 MPa. Apply necessary design checks.



Subject Code: R16ME3202

III B.Tech II Semester Supple Examinations, September-2025

DESIGN OF MECHANICAL COMPONENTS

(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 Bearing Modulus.
(b) Why is the inlet valve port designed larger than the exhaust valve port?
(c) State the function of cylinder liners used in an I.C. Engine.
(d) Mention the important applications of curved beams.
(e) State the few important advantages of the belt drive.
(f) Differentiate between Spur & Helical gear drives.

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

PART-B

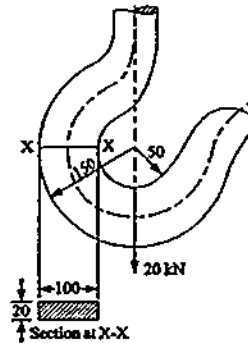
4 X 12 = 48

- 2 a) What are sliding contact bearings? Discuss their advantages over rolling contact bearings? **[4]**
b) A ball bearing subjected to a radial load of 5 kN is expected to have a life of 8000 hours at 1450 r.p.m. with a reliability of 99 percent. Calculate the dynamic load capacity of the bearing so that it can be selected from manufacturer's catalogue based on a reliability of 90 percent. **[8]**
- 3 a) Design a connecting rod for a high-speed I.C. engine using the following data: **[8]**
Cylinder bore = 125 mm
Length of connecting rod = 300 mm
Maximum gas pressure = 3.5 MPa
Length of stroke = 125 mm
Mass of reciprocating parts = 1.6 kg
Engine speed = 2200 r.p.m.
Assume suitable data and state the assumptions made.
b) State the function of the following for an internal combustion engine piston: **[4]**
(i) Ribs ; (ii) Piston rings ; (iii) Piston skirt ; and (iv) Piston pin.
- 4 The following data is given for the piston of a four stroke diesel engine. **[12]**
Cylinder bore = 100 mm
Material of piston rings = grey cast iron
Allowable tensile stress = 90 MPa
Allowable radial pressure on the cylinder wall = 0.035 MPa
Thickness of the piston head = 16 mm
Number of piston rings = 4

Calculate

- Radial width of piston rings & Axial thickness of the piston rings & Gap between the free ends of the piston ring before assembly
- Gap between the free ends of the piston ring after assembly & Width of the top land & width of ring grooves
- Thickness of piston barrel & Thickness of barrel at top end

- 5 a) The crane hook carries a load of 20 kN as shown in Fig. 1. The section at X-X is rectangular whose horizontal side is 100 mm. Find the stresses in the inner and outer fibres at the given section. [8]



Section of X-X (All dimensions in mm)

Fig.1

- Distinguish clearly between direct stress and bending stress. [4]
- 6 a) Two pulleys, one 450 mm diameter and the other 200 mm diameter, on parallel shafts 1.95 m apart are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25? [8]
- What are the advantages and disadvantages of V-belt drive over flat belt drive. [4]
- 7 The following particulars of a single reduction spur gear are given : [12]
- Gear ratio = 10 : 1
- Distance between centres = 660 mm approximately
- Pinion transmits 500 kW at 1800 r.p.m.
- Involute teeth of standard proportions (addendum = m) with pressure angle of 22.5°
- Permissible normal pressure between teeth = 175 N per mm of width.
- Find :
- The nearest standard module if no interference is to occur;
 - The number of teeth on each wheel;
 - The necessary width of the pinion; and
 4. The load on the bearings of the wheels due to power transmitted.



Subject Code: R16ME3203

III B.Tech II Semester Supple. Examinations, September-2025

HEAT TRANSFER

(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 Fourier Law of Conduction? Mention units.
b) Define fin. Write classification of fins
c) Explain Newtonian Law of Cooling
d) Define the Nusselt Number and what its significance is
e) Illustrate different Regimes of Condensation
f) Explain Lambert and Stefan Boltzmann's laws

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

PART-B

4 X 12 = 48

2. (a) Derive three dimensional conduction equation in Cartesian coordinates?
(b) Write the modes of heat transfer and list the applications of heat transfer.
3. (a) Discuss electrical analogy of composite slabs and spheres
(b) Discuss the concept of Semi infinite body
4. (a) Show by dimensional analysis that data for forced convection may be correlated by an equation of the form $Nu = f(Re, Pr)$.
(b) For heating water from 20°C to 60°C an electrically heated tube resulting in a constant heat flux of 10 kW/m² is proposed. The mass flow rate is to be such that $Re_D = 2000$, and consequently the flow must remain laminar. The tube inside diameter is 25 mm. The flow is fully developed (velocity profile). Determine the length of tube required.
5. (a) Explain the phenomena of natural convection over a vertical hot plate. Sketch the boundary layer, temperature and velocity profiles.
(b) Water at 38°C flows over a wide, 6 m long, heated plate at 0.06 m/s. For a surface temperature of 93°C, determine: (a) the hydrodynamic boundary layer thickness δ at the end of the plate (b) the total drag on the surface per unit width (c) The thermal boundary layer thickness δ_t at the end of the plate.
6. (a) Explain drop wise condensation and film condensation.
(b) Discuss the concept of pool boiling.
7. (a) Write classification of heat exchangers and mention the industrial application of heat exchangers.
(b) Write notes on radiation shields. Brief the applications of radiation shields in heat transfer.



Subject Code: R16EC3202

III B.Tech II Semester Supple Examinations, September-2025
MICROWAVE AND OPTICAL COMMUNICATIONS
(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 Reentrant structures used in Klystron tubes?
(b) What are the conditions for which negative resistance occurs in a TED?
(c) Why can't conventional tube devices be used at microwave frequencies above about 1 GHz?
(d) Compare the optical fiber over the copper wire communication system.
(e) What are the light sources commonly used in fiber communications? Compare them.
(f) An InP phototransistor operating at $1.55 \mu\text{m}$ produces a photocurrent of 12 mA for an input optical power of $100 \mu\text{W}$. Calculate the gain of the phototransistor.

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

PART-B

4 X 12 = 48

2. (a) Derive the Telegrapher equations of a Transmission line for T-model.
(b) Derive different field expressions for TM mode existing in Circular Waveguide?
3. (a) What are the applications of a Magic Tee? Find the S-Matrix for a Magic Tee.
(b) Discuss the principle of microwave amplification in a two-cavity Klystron using an Apple-Gate diagram.
4. (a) Write down the working principle of the Gunn diode using the two-valley model theory.
(b) Find out a condition for which negative resistance occurs in the Gunn diode.
5. (a) Describe briefly, with suitable diagrams, the differences in the paths of meridional rays and the skew rays in a step-index fiber. Derive the expression for the acceptance angle for the meridional ray.
(b) What do you mean by V-parameter? Give the expression for the same. Single-mode step-index fiber has a core diameter and numerical aperture of $3 \mu\text{m}$ and 0.1, respectively. Calculate the value of the V-parameter when the wavelength of the propagating wave is $0.8 \mu\text{m}$.
6. (a) Derive Einstein relationships connecting absorption, stimulated emission, and spontaneous emission coefficients.
(b) Write a note on the semiconductor Injection laser or explain the working principle of LASER diode.
7. (a) Explain the detection process in a p-i-n photodiode. Compare the device with the avalanche photodiode.
(b) Derive the condition of lasing in terms of gain and loss coefficients per unit length and the reflectivity of mirrors placed at the end facets of the LASER crystal.

Subject Code: R16EC3203

III B.Tech II Semester Supple Examinations, September-2025

DIGITAL SIGNAL PROCESSING

(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) How do you mathematically determine whether a signal is even or odd?
- (b) Find the inverse FFT of $X[k] = \{5, -1+j, -1, -1-j\}$.
- (c) Obtain the relation between Z-transform and Fourier transform.
- (d) Write the general form of an FIR filter using polyphase decomposition.
- (e) What is the difference between Chebyshev Type-I and Type-II filters?
- (f) How does the window's choice affect the filter's frequency response?

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

PART-B

4 X 12 = 48

2. (a) Compute the energy of the discrete-time signal $x[n] = (0.7)^n u[n]$ and determine whether it is an energy or power signal.
- (b) Given a real-valued periodic signal with Discrete Fourier Series coefficients: $X[k] = \{2, 1+j, -3, 1-j\}$. Verify whether the conjugate symmetry property holds for this signal.
3. (a) Let $X_1[k]$ and $X_2[k]$ are DFTs of the sequences, $x_1[n] = \{1, 2, 1, 0\}$, $x_2[n] = \{0, 1, 2, 1\}$. Verify the linearity property of the DFT for $y[n] = 2x_1[n] + 3x_2[n]$.
- (b) Compute the 4-point DFT of the sequence $x[n] = \{1, -1, 1, -1\}$ using the Radix-2 decimation-in-Frequency (DIF) FFT algorithm.
4. (a) Determine the inverse Z-Transform of $X(z) = \frac{z^2 + 2z + 1}{z - 1}$
- (b) The system function of an IIR filter is: $H(z) = \frac{1 - 0.25z^{-1} + 0.4z^{-2}}{1 - 0.6z^{-1} + 0.2z^{-2}}$.

Draw the transposed Direct Form-II structure and compare it with Direct Form-II.

5. (a) Design an FIR filter using a transversal structure with given specifications: Number of taps: 5; Impulse response: $h[n] = \{1, 2, 3, 2, 1\}$. Analyze the frequency response and discuss stability.
- (b) Analyze the conditions for linear phase in an FIR system. Prove that an FIR filter exhibits linear phase if and only if its impulse response satisfies a symmetry condition.

6. (a) Design a low-pass digital filter using the impulse invariance method for the given analog transfer function: $H(s) = \frac{1}{s^2 + 3s + 2}$. Assume a sampling time of $T = 0.1$ sec.

- (b) Convert the first-order digital low-pass filter:

$$H(z) = \frac{1 + z^{-1}}{1 - 0.5z^{-1}}$$

into a high-pass filter using the lowpass-to-highpass transformation.

7. (a) Derive the impulse response equation for an FIR filter designed using the Rectangular Window and discuss its limitations.

- (b) Design a filter with

$$H_d(e^{jw}) = \begin{cases} -e^{-jw}, & -\frac{\pi}{4} \leq w \leq \frac{\pi}{4} \\ 0, & \frac{\pi}{4} \leq w \leq \frac{3\pi}{4} \end{cases}$$

Using a Hamming window with $N=7$.



Subject Code: R16ME4206

IV B.Tech II Semester Supple Examinations, October-2025

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) Define solar altitude angle
- (b) Name the components of flat-plate collector
- (c) limitations of solar furnace
- (d) List the factors that determine the output from a wind energy convertor.
- (e) Mention some organic materials used in bio-mass plant
- (f) categories of geothermal sources

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

PART-B

4 X 12 = 48

2. (a) Mention the reasons for variation in solar radiation reaching the earth than received at the outside of the atmosphere.
- (b) Describe the working principle and various types of pyranometers in measurement of solar radiation.
3. (a) Explain the principle of conversion of solar energy into heat.
- (b) Enumerate the different types of concentrating type collectors. Describe a collector used in power plant for generation of electrical energy.
4. (a) Write a short note on solar distillation.
- (b) What is principle involved in collection of solar energy used in a non-convective solar pond? Describe a non-convective solar pond for solar energy collection and storage.
5. (a) Discuss the advantages and disadvantages of horizontal and vertical axis windmill.
- (b) Derive the expression of maximum power of a horizontal axis wind turbine.
6. (a) List the main problems encountered in operation of community bio gas plant.
- (b) Explain the constructional detail and working of KVIC digester
7. (a) Give a note on prospects of geothermal energy in context to India.
- (b) What are the various prime movers available for geothermal energy conversion explain about them in brief.

Subject Code: R16ME4202

IV B.Tech II Semester Supple Examinations, October-2025

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 few properties of refrigerant
- (b) Explain the working of expansion device in a VCR system
- (c) A completely odourless refrigerant is not desirable', discuss the statement
- (d) Define DPT, DBT & WBT
- (e) Discuss the idea for summer air conditioning system.
- (f) Explain the usage of fans in air conditioning systems?

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

PART-B

4 X 12 = 48

2. (a) Discuss the advantages and disadvantages of air-refrigeration system. Explain the necessity of cooling aircrafts?
- (b) Explain the working principle of Regenerative air refrigeration system with the help of configuration diagram and temperature-entropy diagram
3. (a) Draw the refrigerator cycle on T-s diagram when the refrigerant is dry and saturated at the end of compression and find an expression for the COP in terms of temperature and entropies.
- (b) A vapour compression machine is used to maintain a temperature of -23°C in a refrigerated space. The ambient temperature is 37°C . The compressor takes in dry saturated vapour of F-12 refrigerant. A minimum 10°C temperature difference is required at the evaporator as well as the condenser. There is no sub-cooling of the liquid. If the refrigerant flow rate is 1 kg/min , find (i) Tonnage of the refrigerant; (ii) Power requirement and (iii) COP of the cycle
4. (a) Write the desirable properties of refrigerants
- (b) Explain in detail, the filters used in air conditioning systems?
5. (a) Discuss the working of Li-Br vapour absorption refrigeration system with neat sketches
- (b) Explain the principle and operation of steam jet refrigeration and thermoelectric refrigeration
6. (a) Define room sensible heat factor. How room sensible heat factor line is drawn on the psychometric chart?
- (b) The air at 35°C DBT and 25°C WBT is passed through a cooling coil at the rate of $280\text{ m}^3/\text{min}$. The air leaves the cooling coil at 26.5°C DBT and 50% relative humidity. Find: i) Capacity of the cooling coil in tonnes of refrigeration; ii) Wet bulb temperature of the leaving air; iii) Water vapour removed per minute; iv) Sensible heat factor.
7. (a) Explain different heat pump circuits
- (b) Explain about Grills and Registers along with their performance effects
