Bharatiya Vidya Bhavan's

# SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

**End Semester/Re-examination December 2025/ ~~January 2026~~**

**Program: F.Y.B.Tech (Civil)** First Year B.tech **Duration: 3 Hours**

**Course Code: BS-BTC101** Civil Engg. **Maximum Points: 100**

**Course Name: Differential Calculus and Complex Numbers** Sem - I

**Semester: I**

29/12/25

**Note:**

1. **Attempt Any Five Questions**
2. **Answers to the sub questions should be grouped together**

| | | Questions | Points | CO | BL | Module |
|---|---|---|---|---|---|---|
| 1 | a | If $\alpha$ and $\beta$ are the roots of the quadratic equation $x^2-2x+4=0$, prove that $\alpha^n+\beta^n=2^{n+1}\cos\left(\frac{n\pi}{3}\right)$ | 6 | 2 | BL2 | 3 |
| | b | If $y=\frac{2x^2-x+1}{(x+1)^2(x+2)(x-3)}$, find $y_n$ | 6 | 1 | BL3,5 | SL |
| | c | If $u\cdot x+v\cdot y=0$ and $\frac{u}{x}+\frac{v}{y}=1$; Prove that $\left(\frac{\partial u}{\partial x}\right)_y-\left(\frac{\partial v}{\partial y}\right)_x=\frac{x^2+y^2}{y^2-x^2}$ | 8 | 1 | BL3 | 1 |
| | | | | | | |
| 2 | a | Prove that $\tan 7\theta=\frac{7\tan\theta-35\tan^3\theta+21\tan^5\theta-\tan^7\theta}{1-21\tan^2\theta+35\tan^4\theta-7\tan^6\theta}$ | 6 | 2 | BL3 | 3 |
| | b | Evaluate $\int_1^{1.6}\frac{1}{2+\log_e x}dx$ by (i) Trapezoidal rule (ii) Simpson's $\frac{1}{3}^{rd}$ rule (iii) Simpson's $\frac{3}{8}^{th}$ rule | 6 | 3 | BL3,5 | 5 |
| | c | If $y=\log\left[x+\sqrt{1+x^2}\right]$, prove that $(1+x^2)y_{n+2}+(2n+1)xy_{n+1}+n^2y_n=0$ | 8 | 1 | BL3 | SL |
| | | | | | | |

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| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | a | If $\sin(\alpha+i\beta)=x+iy$, Prove that<br>$(i)\ \frac{x^2}{\cosh^2\beta}+\frac{y^2}{\sinh^2\beta}=1\quad (ii)\ \frac{x^2}{\sin^2\alpha}-\frac{y^2}{\cos^2\alpha}=1$ | 6 | 2 | BL4 | 4 |
| | b | Divide 150 into three parts so that the sum of their products taken two at a time will be maximum. | 6 | 1 | BL4 2,5 | 2 |
| | c | Solve the following system of Equation using Gauss Jacobi's Iterative method<br>$15x+2y+z=18$<br>$3x-6y+25z=22$<br>$2x+20y-3z=19$ | 8 | 3 | BL3 | 5 |
| | | | | | | |
| 4 | a | Find the root of the equation $x^x=100$, correct to four places of decimals using Newton Raphson method | 6 | 3 | BL4 | 5 |
| | b | If $\cot(\alpha+i\beta)=x+iy$, Prove that<br>$(i)\ x^2+y^2-2x\cot 2\alpha-1=0$<br>$(ii)\ x^2+y^2+2y\coth 2\beta+1=0$ | 6 | 2 | BL3 ,5 | 4 |
| | c | If $z=x\log(x+r)-r$, where $r^2=x^2+y^2$. Prove that<br>$\frac{\partial^2 z}{\partial x^2}+\frac{\partial^2 z}{\partial y^2}=\frac{1}{x+r}$ | 8 | 1 | BL3 | 1 |
| | | | | | | |
| 5 | a | Prove that<br>$\sin^{-1}\left(e^{i\theta}\right)=\cos^{-1}\left(\sqrt{\sin\theta}\right)+i\log\left(\sqrt{\sin\theta}+\sqrt{1+\sin\theta}\right)$ | 6 | 2 | BL4 ,5 | 3 |
| | b | Find the root of the equation $x^3-3x^2+5x-1=0$, correct to four places of decimals using Regula Falsi method | 6 | 3 | BL4 | 5 |
| | c | Find the maximum and minimum value of the function $f(x,y)=x-2y+z$ on the sphere $x^2+y^2+z^2=9$ | 8 | 1 | BL2 BL4 | 2 |
| | | | | | | |
| 6 | a | Find all the roots of the equation $x^7+x^4+ix^3+i=0$ | 6 | 2 | BL3 | 4 |

**End Semester/[redacted]-examination December 2025/ J[redacted]**

| | | | | | | |
|---|---|---|---|---|---|---|
| | b | Find $n^{th}$ derivative of $y = \cos^4 x$ | 6 | 1 | BL3 | SL |
| | c | If $u$ is a homogeneous function of degree $n$ in two variables $x$ and $y$, then prove that<br>$(i)\ x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = nu$<br>$(ii)\ x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = n(n-1)u$ | 8 | 1 | BL1,3 | 1 |
| | | | | | | |
| 7 | a | If $u = x^2 - y^2$, $v = 2xy$ and $z = f(u,v)$, Prove that<br>$\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = 4\sqrt{u^2+v^2}\left\{\left(\frac{\partial z}{\partial u}\right)^2 + \left(\frac{\partial z}{\partial v}\right)^2\right\}$ | 6 | 1 | BL2 | 1 |
| | b | If $u = \tan^{-1}\left(\frac{x^3 - y^3}{x+y}\right)$, Prove that<br>$(i)\ x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$<br>$(ii)\ x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = 2\sin u \cdot \cos 3u$ | 6 | 1 | BL2 | 1 |
| | c | If $u + iv = \frac{1}{i}\log\left[\frac{1+ie^{i\theta}}{1-ie^{i\theta}}\right]$, prove that<br>$u = \frac{\pi}{2}$ and $v = \log(\sec\theta + \tan\theta)$ | 8 | 2 | BL3 | 4 |

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## END SEM/[redacted] EXAMINATION DECEMBER 2025

**Program:** F.Y. B.Tech Civil First Year B.Tech Civil
**Course Code:** BS-BTC-102 Sem - I
**Course Name:** Engineering Chemistry

**Duration:** 180 Min
**Maximum Points:** 100
**Semester:** I

31/12/25

**Instructions:**
1 Question No (Q6) is compulsory
2 Attempt any 4 from Q1, Q2,Q3, Q4,Q5
3 Write the chemical reactions wherever necessary

| Q.No. | Questions | Points | CO | BL | Mod. No. |
|---|---|---|---|---|---|
| **Q1** | | | | | |
| a | Explain the EDTA titration method for determination of total hardness of water with suitable reactions. | 5 | 1 | 1 | 3 |
| b | How does boiling remove temporary hardness of water? Explain briefly. | 5 | 1 | 2 | 3 |
| c | Explain the ion-exchange process for removal of hardness of water with a neat schematic diagram and chemical reactions. Also describe the regeneration of cation and anion exchange resins. | 10 | 1,2 | 2 | 3 |
| **Q2** | | | | | |
| a | Explain the stress corrosion with suitable example | 5 | 1 | 2 | 1 |
| b | Distinguish between dry corrosion and wet corrosion with respect to their mechanism and conditions of occurrence. | 5 | 1 | 1 | 1 |
| c | Describe the mechanism of wet (electrochemical) corrosion with the help of a neat diagram and relevant chemical reactions. | 10 | 1,2 | 2 | 1 |
| **Q3-** | | | | | |
| **a** | Explain the sacrificial anode cathodic protection method for protection of metal from the corrosion process. | 5 | 2,4 | 1 | 2 |
| **b** | Explain the role of corrosion inhibitors in environmental modification for metal protection | 5 | 2,4 | 2 | 2 |
| **c** | Explain different metal coating techniques used for corrosion protection, highlighting their principles and application | 10 | 1,3 | 2 | 2 |

**END SEM/[redacted]- EXAMINATION DECEMBER 2025**

| | | | | | |
|---|---|---|---|---|---|
| **Q4** | | | | | |
| **a** | What is a polymer? Illustrate your answer with appropriate examples. | 5 | 1,3 | 2 | 4 |
| **b** | Explain free radical polymerization mechanism | 5 | 1,3 | 2 | 4 |
| **c** | Describe the intrinsically ,doped conducting , extrinsically and coordination conducting polymer | 10 | 1,4 | 2 | 4 |
| **Q5** | | | | | |
| a | Suggest suitable design modifications to prevent corrosion in outdoor steel structures | 5 | 1 | 2 | 2 |
| b | How silicon nitride is chemically synthesized | 5 | 1,2 | 3 | 4 |
| c | Explain the factors related to metals and the factors related to the environment that affect the rate of corrosion. Give suitable examples. | 10 | 1 | 1 | 1 |
| **Q6** | | | | | |
| a | 50 mL standard hard water containing 1.0mg/mL CaCO3 consumed 50 mL of EDTA.<br>50mL of the unknown hard water sample consumed 48 ml of EDTA using EBT as an indicator. After boiling, filtration of the same hard water 50mL) consumed 30 mL of EDTA using EBT as an indicator Calculate total, permanent and temporary hardness of water | 5 | 1 | 4 | 3 |
| b | Calculate the temporary , permanent and total hardness for water sample contain<br>$Mg(HCO_3)_2$=50mg/L, $CaSO_4$= 25mg/L $CaCl_2$= 10mg/L | 5 | 1 | 3 | 3 |
| c | A 100 ml of sewage water sample was reflexed with 25ml of 0.25N $K_2Cr_2O_7$ in presence of dilute $H_2SO_4$ And $Hg_2SO_4$. The unreacted dichromate required 25mL of 0.25N Ferrous Ammonium sulphate Solution. 20ml of K2Cr2O7 and 50ml of distilled water under same condition as the sample required 48ml of 0. 25N ferrous ammonium sulphate solution. Calculate the COD of the sample | 5 | 1 | 1 | 3 |
| d | Convert the unit<br>65 PPM in to $^0$Fr, $^0$Cl, mg/L<br>35 $^0$Cl in to $^0$Fr , ppm, mg/L | 5 | 1 | 4 | 3 |

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## END SEMESTER EXAMINATION DECEMBER 2025

**Program:** B.Tech (Civil) First Year B.tech Civil **Duration:** 3 Hr

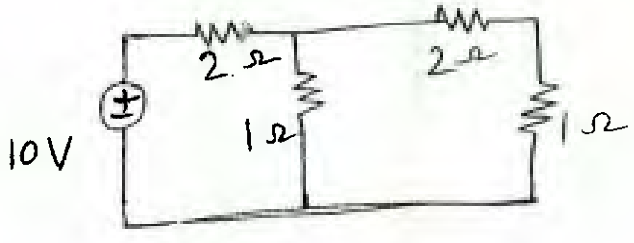
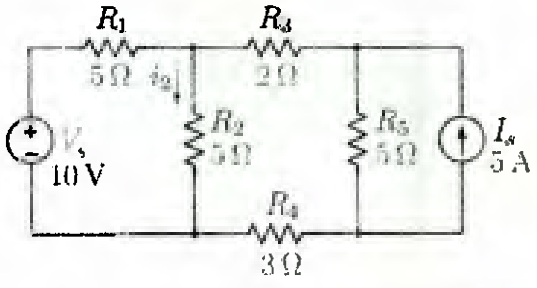
**Course Code:** ES-BTC101 Sem -I **Maximum Points:** 100

**Course Name:** Basic Electrical and Electronics Engineering **Semester:** I

02/01/26

**Notes:** 1) Q 1 is compulsory. Solve any four from remaining questions.

2) Assume Suitable data if required and justify the same.

| Q.No. | Questions | Points | CO | BL | Module No. |
|---|---|---|---|---|---|
| 1a | List any five sensor characteristic and describe them in short. | 05 | 04 | 01 | 05 |
| 1b | State KVL and KCL. Use any one of them to calculate current in all branches of following network.   | 05 | 01 | 01<br>03 | 01 |
| 1c | Explain operation of a BJT as a switch. | 05 | 03 | 01 | 04 |
| 1d | Consider a series RL circuit excited by a single phase AC. Draw phasor diagram and derive expression for current in the circuit. | 05 | 01 | 02 | 02 |
| 2a | Consider a network given below. Determine current and power supplied by 10 V source.   | 10 | 01 | 02<br>03 | 01 |

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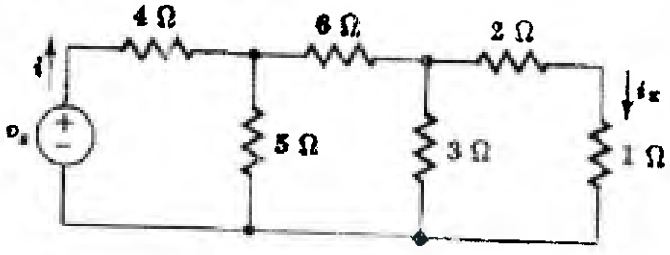
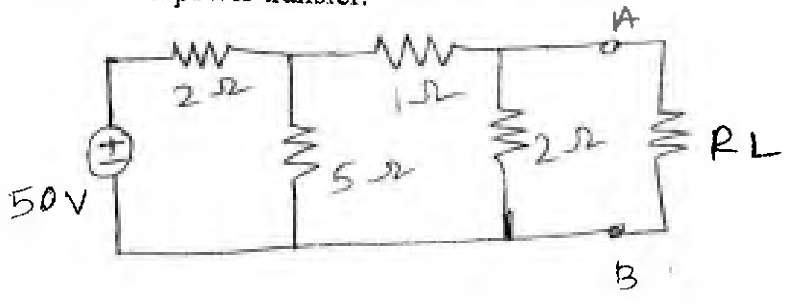
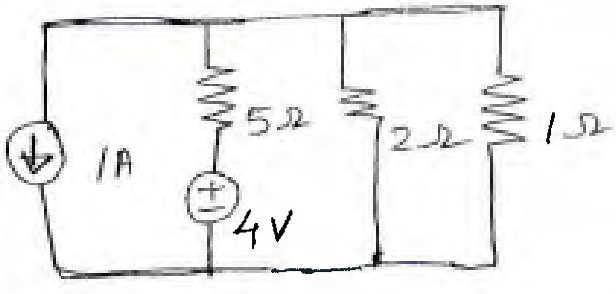
## END SEMESTER EXAMINATION DECEMBER 2025

| | | | | | |
|---|---|---|---|---|---|
| 2b | Determine Norton's equivalent circuit across 1 ohm resistor. Hence the value of ix, if the supply voltage Vs=20 V.<br>  | 10 | 01 | 02<br>03 | 01 |
| 3a | Consider a following network. Calculate voltage, power consumption and current through the load resistance $R_L$ when its value is adjusted for maximum power transfer.<br>  | 10 | 01 | 02<br>03 | 01 |
| 3b | Using superposition theorem, determine current through 1Ω.<br>  | 10 | 01 | 02<br>03 | 01 |
| 4a | A resistor of 100Ω is connected in series with a 100 μf capacitor. This circuit is connected to a 220V, 50Hz supply. Determine a) impedance b) current c) power factor e) voltage across resistor and voltage across capacitor. | 10 | 01 | 02<br>03 | 02 |
| 4b | Determine the expression for current i(t) in sinusoidal form, and calculate real, reactive and apparent power when a voltage ϑ(t)=120V, 60 Hz is applied to a coil having resistance of 5Ω and inductance L=0.01H. | 10 | 01 | 02<br>03 | 02 |

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| | | | | | |
|---|---|---|---|---|---|
| 5a | Derive the relation for power in three phase balanced system. | 05 | 01 | 02 | 02 |
| 5b | Derive the relation between line and phase quantities for a star connected three phase load. Draw the phasor diagram (only voltage phasors).<br>A balanced star-connected load has an impedance of (10 + j6) Ω per phase and is connected to a 400 V, 3-phase supply. Determine the line and phase current. | 10 | 01 | 02<br>03 | 02 |
| 5C | Explain working principle of single phase induction motor. | 05 | 02 | 01 | 03 |
| 6a | Explain working principle and characteristics of a n-p-n transistor. Explain common emitter configuration. | 10 | 03 | 02 | 04 |
| 6b | Explain working principle of half full wave rectifier with neat diagram and waveforms. | 10 | 03 | 02 | 04 |
| 7a | Explain working principle of a transformer. List different types of transformer and explain in detail. | 10 | 02 | 01<br>02 | 03 |
| 7b | List different classifications of sensors.<br>Describe working principle of any two sensors. | 10 | 04 | 01<br>02 | 05 |

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**END SEMESTER December 2025 / RE - EXAM February 2026**

**0Program: F.Y.BTech (Civil)** First Year B.Tech Civil **Duration: 3 hours**

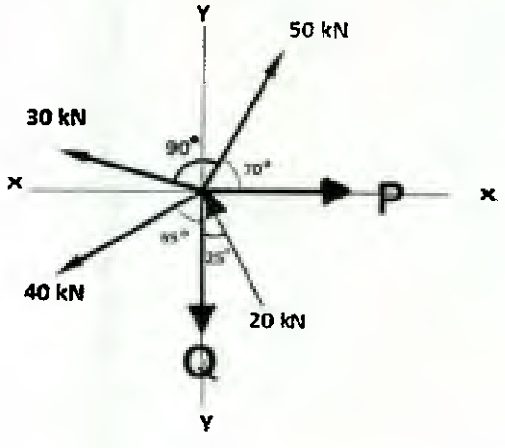
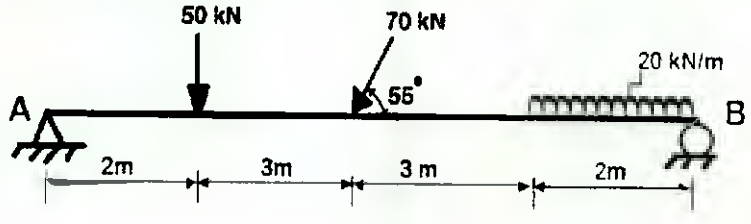
**Course Code: ES-BTC102** Sem - I **Maximum Points: 100**

**Course Name: Engineering Mechanics-I (R23)** **Semester: I**

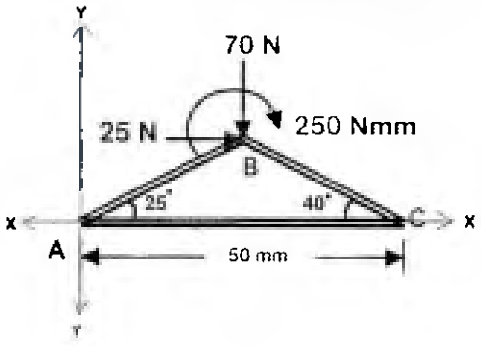
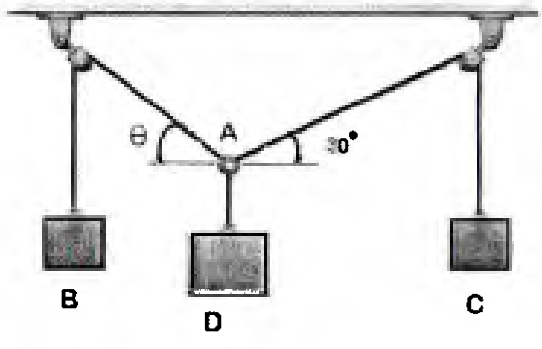
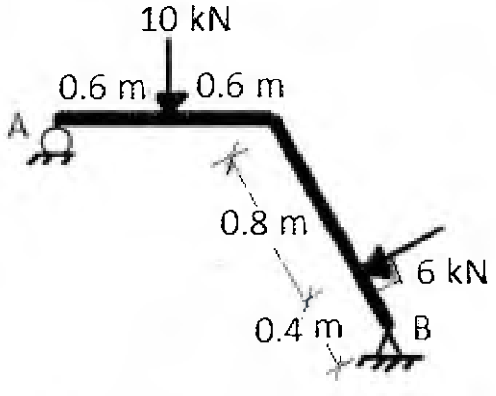
05/01/26

**Notes:**

1. Attempt **any five** out of the seven questions.
2. Start each new question on a new page. All sub-questions should be written grouped together.
3. Assume suitable data if necessary and state it clearly.
4. Use of scientific calculator is permitted.

| Q.No. | Questions | Points | CO | BL | Module No. |
|---|---|---|---|---|---|
| Q.1(a) | Six concurrent forces act on a body as shown in the figure. Compute the forces **P and Q** such that the resultant of all forces is equal to zero.   | 10 | 1 | 2,3 | I |
| Q.1(b) | Calculate the reactions at support A and B for the beam loaded as shown below.   | 10 | 1 | 2,3 | 2 |

**END SEMESTER December 2025 / RE - EXAM February 2026**

| | | | | | |
|---|---|---|---|---|---|
| Q.2(a) | Calculate (i) the magnitude and (ii) direction of the resultant of the forces acting on triangular bracket as shown in diagram.<br>Also calculate<br>(iii)X-intercept and<br>(iv) Y-intercept |  | 10 | 1 | 2,3 | 1 |
| Q.2(b) | (i) State and explain Lami's theorem.<br>(ii) Apply Lami's theorem to solve the following problem.<br><br>If block D weighs 300 N and block B weighs 275 N, determine the required weight of block C and angle θ for equilibrium using Lami's theorem |  | 10 | 1 | 2,3 | 2 |
| Q.3(a) | Determine the normal reaction at the roller support A and horizontal and vertical components at pinned support B for equilibrium of the structure. |  | 10 | 1 | 2,3 | 2 |

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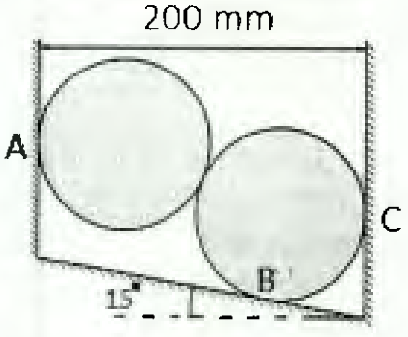
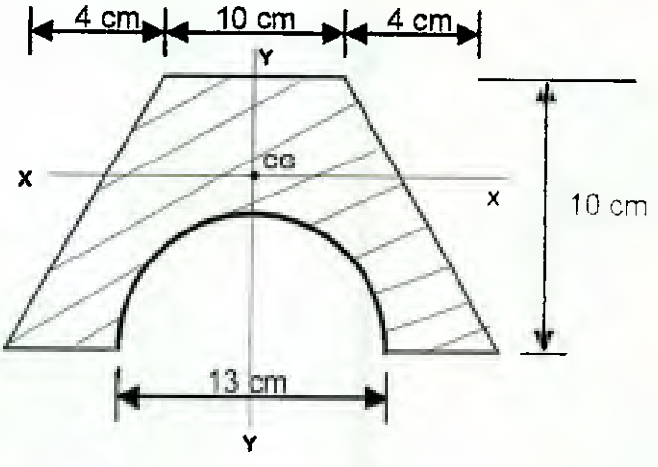
## END SEMESTER December 2025 / RE - EXAM February 2026

| | | | | | |
|---|---|---|---|---|---|
| Q.3(b) | (i) State and explain the parallel axis theorem with suitable diagram.<br><br>(ii) Derive the formula for moment of inertia of a rectangle about its base, using parallel axis theorem | 10 | 3 | 2 | 5 |
| Q.4(a) | Two identical cylinders of diameter 150 mm and each weighing 300 N are placed in a container as shown in figure below. All the contact surfaces are smooth. Find the reactions at A, B, and C   | 10 | 1 | 2,3 | 2 |
| Q.4(b) | Explain the following with suitable diagrams:<br>(i) Product of inertia,<br>(ii) Polar moment of inertia | 10 | 3 | 2 | 5 |
| Q.5 | Calculate the moment of inertia of the following shaded area **about its own centroidal axes.** (Note: First calculate the center of gravity of the shaded area and then calculate $I_{CG}xx$ and $I_{CG}yy$ )   | 20 | 3 | 2,3 | 5 |

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## END SEMESTER December 2025 / RE - EXAM February 2026

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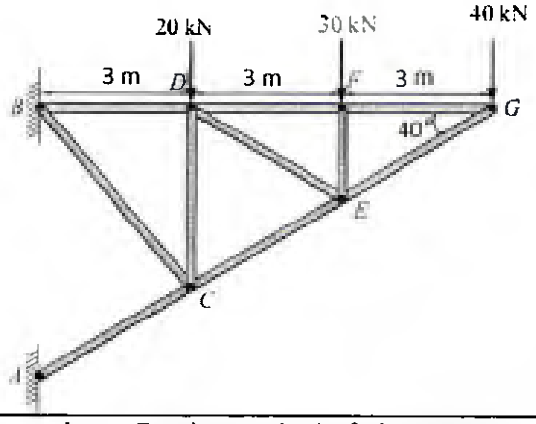
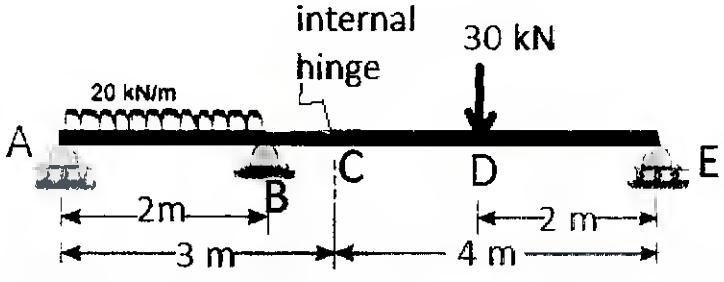
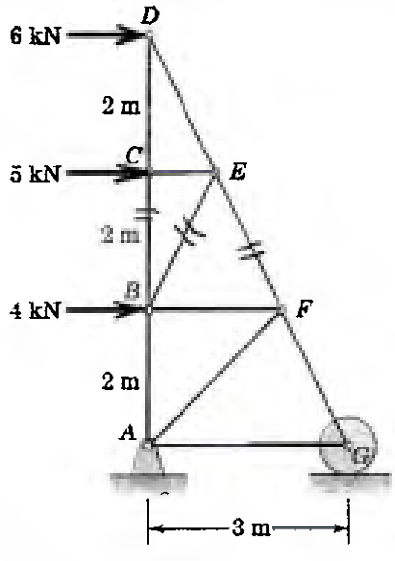
|---|---|---|---|---|---|
| Q.6 | Calculate forces in all the members of the following truss using method of joints   | 20 | 2 | 2,3 | 3 |
| Q.7(a) | Calculate the support reaction at B using method of virtual work. Note : C is an internal hinge.   | 10 | 4 | 2,3 | 4 |
| Q.7(b) | Determine the forces in members ***BC, BE, and EF*** of the truss shown using **method of section**   | 10 | 2 | 2,3 | 3 |

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**~~END SEMESTER December 2025~~ / RE - EXAM February 2026**

**Program:** F.Y.BTech (Civil) First Year B.tech Civil **Duration: 3 hours**

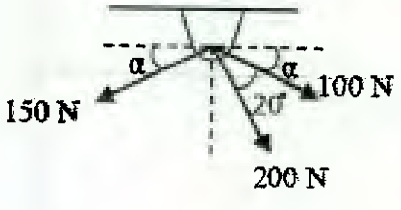
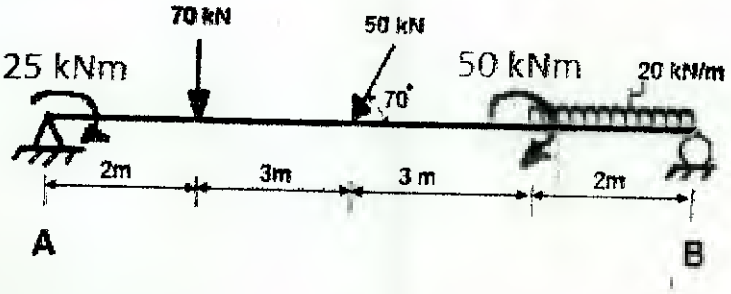
**Course Code:** ES-BTC102 **Maximum Points: 100**

**Course Name:** Engineering Mechanics-I (R23) **Semester: I**

12/02/26

**Notes:**

1. Attempt **any five** out of the seven questions.
2. Start each new question on a new page. All sub-questions should be written grouped together.
3. Assume suitable data if necessary and state it clearly.
4. Use of scientific calculator is permitted.

| Q.No. | Questions | Points | CO | BL | Module No. |
|---|---|---|---|---|---|
| Q.1(a) | For the force system shown, determine (i) the required value of angle alpha, if the resultant of three forces is to be vertical. And (ii) corresponding magnitude of resultant.   | 10 | L | 2,3 | 1 |
| Q.1(b) | Calculate the reactions at support A and B for the beam loaded as shown below.   | 10 | 1 | 2,3 | 2 |

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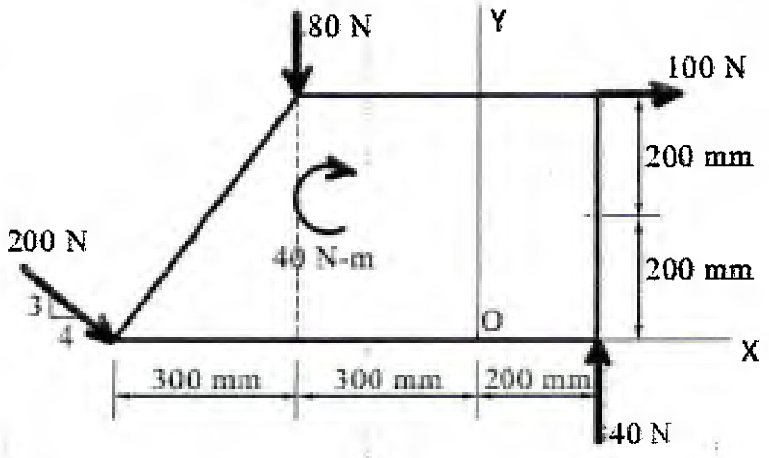
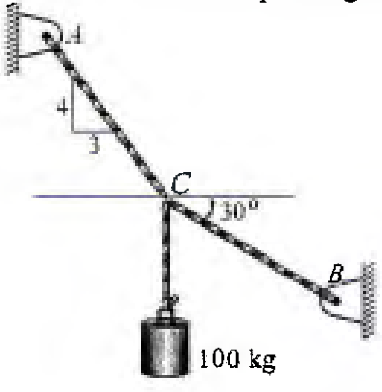
**~~END SEMESTER December 2025~~ / RE - EXAM February 2026**

| | | | | | |
|---|---|---|---|---|---|
| Q.2(a) | Calculate (i) the magnitude and (ii) direction of the resultant of the forces acting on the plate as shown in diagram. Also calculate (iii)X-intercept and (iv) Y-intercept   | 10 | 1 | 2,3 | 1 |
| Q.2(b) | (i) State and explain Lami's theorem.<br>(ii) Apply Lami's theorem to solve the following problem.<br>Calculate tension in each rope using Lami's theorem   | 10 | 1 | 2,3 | 2 |

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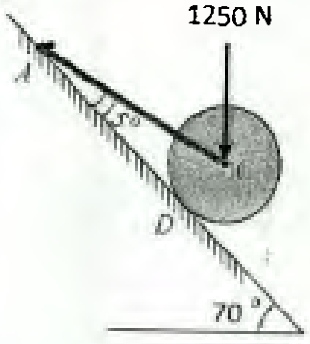
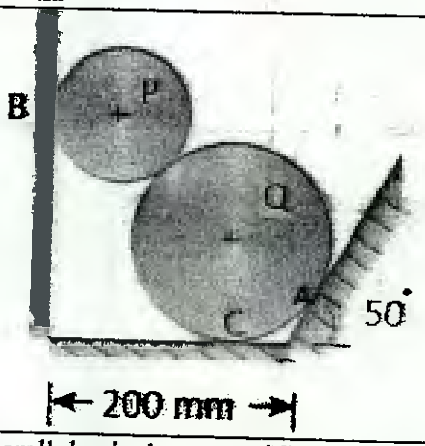
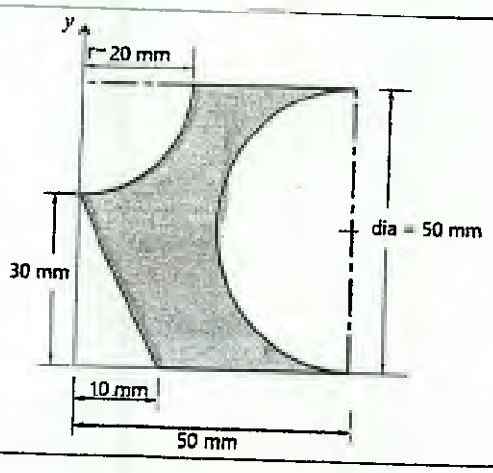
## ~~END SEMESTER December 2025~~ / RE - EXAM February 2026

| | | | | | |
|---|---|---|---|---|---|
| ~~Q.3(a)~~ | A roller of weight 1250 N rests on a smooth inclined plane by string AC as shown. Calculate the tension in the string and reaction at the point of contact D   | 10 | 1 | 2,3 | 2 |
| Q.3(b) | Explain the following with suitable diagrams:<br>(i) Product of inertia,<br>(ii) Polar moment of inertia | 10 | 3 | 2 | 5 |
| Q.4(a) | The cylinder P has diameter of 100 mm and weighs 300 N, whereas the cylinder Q has diameter of 180 mm and weighs 550 N. Calculate the reaction forces at points of contact A, B, and C   | 10 | 1 | 2,3 | 2 |
| Q.4(b) | (i) State and explain the parallel axis theorem with suitable diagram. (ii) Derive the formula for moment of inertia of a triangle about its base, using parallel axis theorem | 10 | 3 | 2 | 5 |
| Q.5 | Calculate the moment of inertia of the following shaded area **about its own centroidal axes.** (Note: First calculate the center of gravity of the shaded area and then calculate $I_{CGXX}$ and $I_{CGYY}$ )   | 20 | 3 | 2,3 | 5 |

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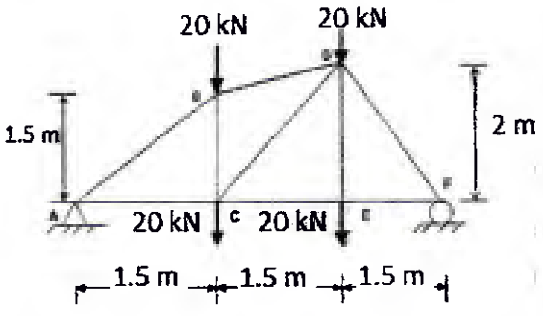
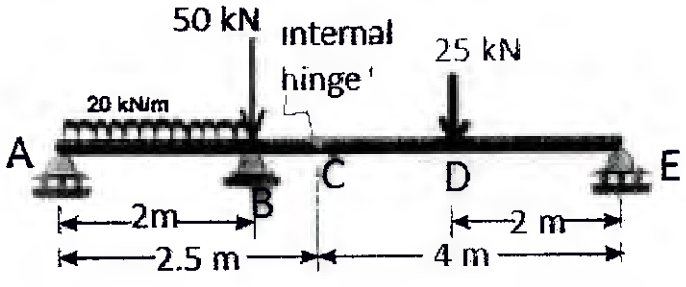
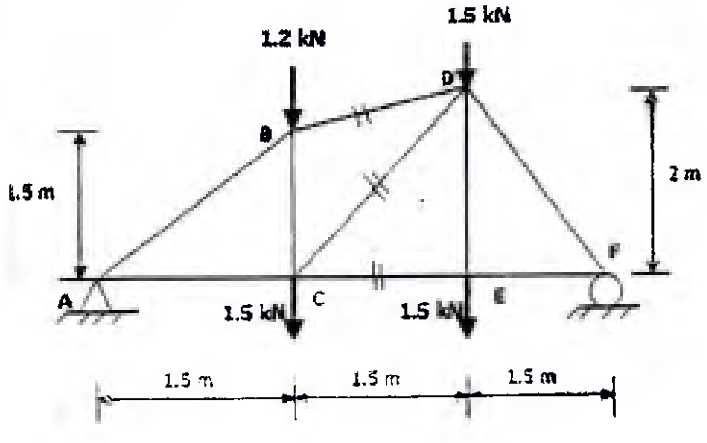
**~~END SEMESTER December 2025~~ / RE - EXAM February 2026**

| | | | | | |
|---|---|---|---|---|---|
| Q.6 | Calculate forces in all the members of the following truss using method of joints   | 20 | 2 | 2,3 | 3 |
| Q.7(a) | Calculate the support reaction at B using method of virtual work. Note : C is an internal hinge.   | 10 | 4 | 2,3 | 4 |
| Q.7(b) | Determine the forces in members ***BD, CD, and CE*** of the truss shown using **method of section**   | 10 | 2 | 2,3 | 3 |

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## END SEMESTER December 2025 / RE - EXAM February 2026

**Program: F.Y.B. Tech** First Year B. Tech Civil

**Course Code: BS-BTC/M/E-103** Sem-I

**Course Name: BIOLOGY FOR ENGINEERS**

**Duration: 2 hrs.**

**Maximum Points: 50**

**Semester: I**

07/01/26

**Notes: Attempt any five questions out the following.**

| Q.No. | Questions | Points | CO | BL | Module No. |
|---|---|---|---|---|---|
| 1. | a) Explain the role of fossils in understanding evolutionary relationships of organisms. | 5 | 1 | 1 | 1 |
| | b) State the importance and requirements of biology for engineering students. | 5 | 2 | 4 | 1 |
| 2. | Describe Mendel's dihybrid cross taking two contrasting characters in pea plants. | 10 | 1 | 1 | 2 |
| 3. | Explain the process of DNA replication. | 10 | 1 | 1 | 3 |
| 4. | Echolocation is widely applied in technologies such as ultrasonography and SONAR. Discuss the working principle, advantages, and engineering significance of echolocation-based systems. | 10 | 1/2 | 1/4 | 4 |
| 5. | a) What is a bionic leaf? Explain its working principle and state its importance. | 5 | 3/4 | 2 | 4 |
| | b) What are HBOCs? How do they function as artificial blood substitutes? Discuss their advantages and uses. | 5 | 1/4 | 1/3 | 4 |
| 6. | a) Explain how 3D printing technology is used to create artificial ear and bone structures. | 5 | 2/4 | 2/4 | 5 |
| | b) Describe the mechanism of crack healing in Bio concrete. | 5 | 4 | 4 | 5 |
| 7 | a) Explain how an electrical nose helps in identifying food adulteration. | 5 | 2/4 | 1/4 | 5 |
| | b) What is interphase? Describe the different stages of interphase with suitable points? | 5 | 1 | 1 | 2 |

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## ~~END SEMESTER December 2025~~ / RE - EXAM February 2026

**Program:** F.Y.B. Tech First Year B.Tech Civil **Duration: 2 hrs.**

**Course Code:** BS-BTC/M/E-103 **Maximum Points: 50**

**Course Name:** BIOLOGY FOR ENGINEERS **Semester: I**

13/02/26

**Notes: Attempt any five questions out the following.**

| Q.No. | Questions | Points | CO | BL | Module No. |
|---|---|---|---|---|---|
| 1. | a) Explain the role of connecting links in understanding evolutionary relationships. | 5 | 1 | 1 | 1 |
| | b) State the importance and requirements of biology for engineering students. | 5 | 2 | 4 | 1 |
| 2. | a) Describe the different sub-stages of Prophase-I in meiosis. | 5 | 1 | 2 | 2 |
| | b) Explain Mendel's monohybrid cross with a suitable example. | 5 | 1 | 1 | 2 |
| 3. | Describe the structure of DNA in detail. | 10 | 1 | 1 | 3 |
| 4. | a) Discuss the lotus leaf effect as an example of biomimicry. | 5 | 3 | 2 | 4 |
| | b) Explain how bird navigation has inspired the development of GPS technology. | 5 | 4 | 4 | 4 |
| 5. | a) Describe the different types of bioremediation. | 5 | 2 | 3 | 5 |
| | b) Describe the mechanism of crack healing in bioconcrete. | 5 | 4 | 4 | 5 |
| 6. | During a medical emergency where compatible donor blood is unavailable, doctors decide to use a human blood substitute. Explain what a human blood substitute is, describe its types and working principle, and discuss its advantages, limitations, and significance in emergency medical care. | 10 | 2/4 | 3/4 | 4 |
| 7. | a) Explain the significance of mitosis in living organisms. | 5 | 1 | 1 | 2 |
| | b) An electrical tongue is widely used to detect taste variations and adulteration in food products. Justify | 5 | 3 | 2 | 5 |

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**RE ~~END~~ Semester 2025 Examinations**
**~~DECEMBER 2025~~ FEB 2026**
**Design Thinking and Innovation SET 01**

17/02/26

**Semester I**

**Program: First Year B. Tech CME** **Duration 02 Hours**

**Code: SE BTC 101** **Marks 50**

## Instructions

1. **Question 01 is compulsory**
2. **Attempt any 04 questions out of remaining 06**
3. Each question carries **10 marks.**
4. Figures to the right indicate full marks.
5. Support answers with examples and diagrams wherever necessary.

| Sr.No | Questions | Marks | Module | BL |
|---|---|---|---|---|
| Q.1. | **Case Study:**<br>A university wants to redesign their **student online exam registration portal**, which currently suffers from:<br>• Frequent login failures<br>• Slow interface<br>• Confusing navigation<br>• Limited accessibility for differently abled students<br>Using **all five stages** of Design Thinking, outline a **step-by-step approach** to redesign the portal and propose the final output. | **10** | **01to 05** | **4,5,6** |
| **Q. 2.** | Explain the importance of the **Empathize** stage in the Design Thinking process. How does empathy contribute to user-centric innovation? Differentiate between **empathy** and **sympathy** in the context of design research, explaining why misunderstanding this difference can lead to failed innovations. | **10** | **02** | **1,2** |
| **Q.3.** | A metropolitan city is facing a rising number of road accidents involving pedestrians near school zones.<br>a) Identify and list the **poiuts of stakeholders** involved (students, parents, police, vehicle drivers, local residents). b) Write a **problem statement** using the format:<br>**"[User] needs a way to [need] because [insight]"** | **10** | **01,02** | **2,3** |
| **Q.4.** | Apply the **SCAMPER** method to improve a **traditional classroom desk and bench** system and list **five iunovative ideas** generated. | **10** | **03** | **3,4** |
| **Q.5.** | **Multiple Choice Questions: Attempt All** | **10** | **1 to 5** | **1,2,3** |

| | | | | |
|---|---|---|---|---|
| | 1. Which of the following is the first stage of Design Thinking?<br>a) Test b) Empathize c) Ideate d) Prototype<br>2. "How might we" questions are typically formed during which stage?<br>a) Empathize b) Define c) Prototype d) Test<br>3. SCAMPER method is primarily used for:<br>a) Idea generation b) Testing c) Identifying users d) Market research<br>4. A low-fidelity prototype is usually:<br>a) Fully functional b) Expensive c) Rough & quick representation d) Final version<br>5. Which of the following is NOT a divergence technique?<br>a) Brainstorming b) Ideation c) SCAMPER d) Filtering<br>6. Persona creation is done during which stage?<br>a) Define b) Test c) Prototype d) Empathize<br>7. Which is primarily used for validating a prototype?<br>a) Surveys b) Testing with real users c) Idea sketching d) Brainstorming<br>8. The reliability of feedback increases when:<br>a) The number of participants is small<br>b) Users represent real stakeholders<br>c) Testing is informal only<br>d) Testing has no structure<br>9. The stage where assumptions are challenged & feasibility is verified:<br>a) Prototype b) Empathize c) Test d) Ideate<br>10. A good problem statement must NOT be:<br>a) Human-centered b) Broad c) Actionable d) Insight-based | | | |
| **Q.6.** | **Evaluate the following scenario:**<br>A startup has ideated a **smart water bottle** that reminds users to drink water using sound and LED alerts.<br>a) Suggest what physical or digital prototypes they could develop at early and later stages.<br>b) Discuss **five factors** that determine prototype selection in real-world innovation projects. | **10** | **04** | **3,4** |
| **Q.7.** | A prototype for a **mobile app for visually impaired people** is being tested.<br>a) Explain the importance of **testing and feedback** for refining solutions.<br>b) Design a **test plan** including testing objectives, sample users, feedback tools, and measurement metrics. | **10** | **05** | **3,5** |
| | ***All the Best*** | | | |

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**END Semester 2025 Examinations**
**DECEMBER 2025**
**Design Thinking and Innovation SET II**

**Semester I**

**Program: First Year B. Tech CME** First Year B.tech Civil, Sem-I **Duration 02 Hours**

**Code: SE BTC 101** **Marks 50**

09/01/26

**Instructions**

1. **Question 01 is compulsory**
2. **Attempt any 04 questions out of remaining 06**
3. Each question carries **10 marks.**
4. Figures to the right indicate full marks.
5. Support answers with examples wherever necessary.

| Sr.No | Questions | Marks | Module | BL |
|---|---|---|---|---|
| Q.1. | An Ed-Tech startup wants to redesign their **online examination integrity system** due to rising concerns such as cheating, camera privacy issues, poor internet connectivity and student anxiety. Apply **all five stages of Design Thinking** to propose:<br>• Key research steps<br>• Data synthesis approach<br>• Ideation strategy<br>• Prototype types<br>• Comprehensive testing plan | **10** | **01to 05** | **5,6** |
| Q. 2. | You are designing a solution for managing long queues at hospital OPD registration counters. List **any five empathic research methods** and describe **how each will help you understand user pain points.** | **10** | **02** | **1,2** |
| Q.3. | The government wants to redesign the **public transportation ticketing system** due to long queues, system crashes, and inconvenience for tourists.<br>a) Perform **a root cause analysis** using Empathy Mapping. Write **two different POV (Point of View) statements** from the perspectives of: 1. A daily office commuter. 2. A foreign tourist with no local language knowledge | **10** | **01,02** | **2,3** |
| Q.4. | Use **Six Thinking Hats** to generate insights for designing a solution to reduce **campus food waste** in college canteens. Present your response under **each Hat.** | **10** | **03** | **3,4** |

| | | | | |
|---|---|---|---|---|
| **Q.5.** | **Multiple Choice Questions:**<br><br>1. Empathy maps typically include all of the following EXCEPT:<br>a) Says b) Does c) Thinks d) Rewards<br>2. A meaningful POV statement must include:<br>a) Insight, Need, User b) Budget, Timeline, Scope c) Data, Validation, Evidence d) Persona, Demographics, Design brief<br>3. Divergent & convergent thinking are critical in:<br>a) Only ideate stage b) Throughout process c) Only prototype stage d) Only testing stage<br>4. The **5-Whys technique** is primarily used for:<br>a) Ideation b) Problem definition c) Market launching d) User testing<br>5. In Six Thinking Hats, the **Black Hat** symbolizes:<br>a) Creativity b) Positive judgement c) Critical judgement d) Emotions<br>6. The primary purpose of a **high-fidelity prototype** is:<br>a) Conceptual understanding b) Quick sketches c) Final user experience simulation d) Low-cost basic model<br>7. Which testing approach ensures **real-world scenario validation**?<br>a) Lab experiment b) Field trial c) Simulation only d) Brainstorm review<br>8. A design failure due to ignoring user emotions represents a breakdown in:<br>a) Ideate stage b) Empathize stage c) Prototype stage d) Test stage<br>9. **Critical-to-quality (CTQ)** metrics are most relevant in:<br>a) Prototype validation b) Mind mapping c) Persona design d) Empathy interviewing<br>10. Which statement best reflects **convergent thinking**?<br>a) Expanding options without judgement<br>b) Choosing the best alternative among many<br>c) Encouraging wild ideas<br>d) Generating diverse solutions | **10** | **1 to 5** | **1,2,3** |
| **Q.6.** | A company is developing a **wearable stress-monitoring wristband** for corporate employees.<br>a) Propose **two low-fidelity prototypes** and **two high-fidelity prototypes** and justify the purpose of each.<br>b) Evaluate the **risk-benefit trade-offs** that should be considered before scaling the prototype for real-market launch. | **10** | **04** | **3,4** |
| **Q.7.** | A prototype AI-based **smart library recommendation system** has been developed to assist students in book selection.<br>a) Design a **pilot testing plan** including sampling strategy, testing tools, success metrics, and feedback capture mechanisms. | **10** | **05** | **3,5** |
| | ***All the Best*** | | | |

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End Semester Examinations/[redacted] Sem I 2025-26

First Year B.Tech January 2026/[redacted]

12/01/26

PROGRAM: **F.Y.B Tech (Civil/Mechanical/Elect)** TIME: **2.00 Hrs.**

COURSE CODE: **VE-BTC101/BTM-101/BTE101** COURSE NAME: **Ethics, Values and Life Skills**

Sem – I MAX MARK: **50**

- **Answer any five from Q1 to Q6. Answers to MCQs should be supported by proper reasoning!**
- **For each question, Course Outcome number (CO), Blooms' Level (BL), Module Number (MN) are indicated against it respectively.**
- **There can be possibilities of multiple choices being correct. You will score complete marks if and only if you mark all the multiple choices correctly. 50% correct will not allot you 50% marks!**
- **The questions asked do not resemble anyone in particular. These are based only on certain imaginary/probably real life case studies. Any resemblance to actual persons, is purely coincidental!**
- **Marks will be given on the basis of what will be written in the paper irrespective of your intentions.**

Good luck!

| | All MCQs are of 2 mark each | CO | BL | MN |
|---|---|---|---|---|
| Q1) | | | | |
| a. | A person practices honesty at home but manipulates data at work. This primarily reflects lack of harmony at which level?<br>a. Self b.Family<br>c. Society d. Nature | 1 | 2 | 2 |
| b. | Which is the most accurate sequence for establishing lasting harmony?<br>a. Society → Nature → Family → Self<br>b. Self → Family → Society → Nature<br>c. Nature → Society → Self → Family<br>d. Family → Self → Society → Nature | 2 | 1 | 2 |
| c. | A student spends excessive time on social media during hostel hours and feels stressed before exams. Which action best reflects effective self-management?<br>a. Deleting all social media accounts permanently<br>b. Efficient time-management and setting usage limits<br>c. Studying only at night<br>d. Ignoring stress symptoms | 4 | 2 | 4 |
| d. | A student avoids using a mobile phone in class only when the professor is present. This behavior is an example of:<br>a. Self-control b. Ethical discipline<br>c. Self-restraint d. Internal motivation | 5 | 2 | 5 |
| Q2) | | | | |
| a | A student consistently overcommits to clubs, sports, and academics, leading to burnout. The best self-management decision is to:<br>a. Quit all activities<br>b. Continue without rest<br>c. Set realistic limits and prioritize commitments | 4 | 2 | 4 |

| | | | | |
|---|---|---|---|---|
| | d. Focus only on academics | | | |
| b | A student controls personal convenience by reducing water and electricity usage in the hostel. Which stage/s of harmony is/are taken care of considering long-term sustainability mindset?<br>a. Self b. Family<br>c. Society d. Nature | 2 | 1 | 2 |
| c | A student tops the semester but openly acknowledges the help of classmates and seniors. This behavior best reflects:<br>a. Self-confidence b. Humility<br>c. Righteousness d. Sympathy | 5 | 1 | 5 |
| d | Egolessness most directly contributes to harmony at which level first?<br>a. Self b. Society<br>c. Family d. Nature | 4 | 2 | 4 |
| Q3) | | | | |
| a | Bouncing back from failure without losing confidence best illustrates:<br>a. Self management b. Self resistance<br>c. Humility d. Tolerance | 5 | 2 | 5 |
| b. | Which situation BEST represents an ethical dilemma?<br>a Choosing between two equally efficient designs<br>b. Choosing between meeting a deadline and ensuring complete safety testing<br>c. Following work policy | 1 | 2 | 1 |
| c. | Morals are often professional and legal guidelines<br>a. True b. False | 2 | 1 | 2 |
| d. | A value-based work culture in a hostel is best sustained by:<br>a. Tolerance b. Harmony<br>c. Self resistance d. Integrity | 2.5 | 1 | 2.5 |
| Q4) | | | | |
| a | A class topper accepts multiple responsibilities and misses deadlines. What indicates the virtue of humility in him/her?<br>a. Seeking help b. Overcommitment without realistic planning<br>c. Delegating tasks d. Setting priorities | 2 | 1 | 2 |
| b | Which behavior BEST reflects humility in a group project?<br>a. Taking credit for team success<br>b. Ignoring others' ideas<br>c. Acknowledging team contributions (ans)<br>d. Remaining silent during discussions | 1 | 2 | 1 |
| c | A classmate says, *"At least it's not worse"*, to someone who failed an exam. This response best represents:<br>a. Empathy b. Sympathy<br>c. Integrity d. Righteousness | 1 | 2 | 1 |
| d | A hostel roommate follows a different daily routine that causes minor inconvenience to his/her peers. Which virtue best shows adjusting expectations and communicating respectfully?<br>a. Tolerance b. Self-control<br>c. Integrity d. Humility | 2 | 2 | 2 |

| | | | | |
|---|---|---|---|---|
| Q5) | | | | |
| a | Which of the following is NOT a characteristic of humility?<br>a. Willingness to learn b. Respect for others<br>c. Ego-driven behavior d. Acceptance of feedback | 1 | 2 | 1 |
| b | During a difficult semester, a group of engineering students study together, share notes, and motivate each other without expecting any personal gain. This behavior best reflects:<br>a. Friendship b. Competition<br>c. Comradeship d. Sympathy | 1 | 2 | 1 |
| c | Empathy means:<br>a. Feeling sorry for others b.Ignoring others' feelings<br>c. Understanding others' emotions d.Putting yourself in others shoes | 5 | 1 | 5 |
| d | Integrity is connected in an important way to acting morally.<br>a. True b. False | 5 | 1 | 5 |
| Q6) | | | | |
| a | Which of the following do(es) not show comradeship?<br>a. A student helps only close friends with notes but ignores others in the group.<br>b. students enjoy spending free time together, but avoid academic collaboration.<br>c. In a hostel, students from different batches support each other during exam stress, even without personal closeness.<br>d. Supporting someone due to emotional closeness | 5 | 1 | 5 |
| b | Tolerance primarily involves:<br>a. Agreeing with everyone b. Avoiding people<br>c. Respecting differences d .Suppressing emotions | 5 | 1 | 5 |
| c | Which of the following show egolessness?<br>a. Having a feel of defeating everything rather than doing best<br>b. Feeling jealous of others' performance<br>c. Getting less personal about things<br>d. Knowing that you are not the best | 1 | 2 | 1 |
| d | Harmony in life means:<br>a. Absence of problems b.Balance at all levels<br>c. Ignoring conflicts d. Following rules blindly | 1 | 1 | 1 |
| Q7) | (10 marks) | | | |
| a | State and describe the steps to achieve self control. | 5 | 2 | 5 |
| | **OR** | | | |
| b | Imagine your friend asks to put his/her proxy for a lecture since he/she does not meet the required attendance criteria in the college and is travelling for his/her sister's wedding. On the way to the wedding, an accident takes place and he/she is missing during the accident. Upon the police enquiry, they come to know that the student's proxy was marked which indicated his/her presence in the college.<br>Q1) Mention the ethical dilemmas faced by you. Q2) Justify your decision making using the four warning signs Q3)Mention the set of virtues you should have in you while tackling the ethical dilemma/s. | 1 | 3 | 1 |

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18/02/26

~~End Semester Examinations~~/Re-Examinations Sem I 2025-26

First Year B.Tech Civil ~~January 2026~~/February 2026 Sem - I

PROGRAM: **F.Y.B Tech (Civil/Mechanical/Elect)** TIME: **2.00 Hrs.**

COURSE CODE: **VE-BTC101/BTM-101/BTE101** COURSE NAME: **Ethics, Values and Life Skills**

MAX MARK: **50**

- **Answer any five from Q1 to Q6. Answers to MCQs should be supported by proper reasoning!**
- **For each question, Course Outcome number (CO), Blooms' Level (BL), Module Number (MN) are indicated against it respectively.**
- **There can be possibilities of multiple choices being correct. You will score complete marks if and only if you mark all the multiple choices correctly. 50% correct will not allot you 50% marks!**
- **The questions asked do not resemble anyone in particular. These are based only on certain imaginary/probably real life case studies. Any resemblance to actual persons, is purely coincidental!**
- **Marks will be given on the basis of what will be written in the paper irrespective of your intentions.**

Good luck!

| | All MCQs are of 2 mark each | CO | BL | MN |
|---|---|---|---|---|
| Q1) | | | | |
| a | Roommates in a hostel discuss conflicts openly, respect each other's routines, and arrive at mutual agreements. This demonstrates harmony between:<br>a. Self and family b.Family and nature<br>c. Society and nature d. Self and Nature | 1 | 2 | 2 |
| b | Which is the fourth stage of harmony?<br>a. Self b. Nature<br>c. Society d. Family | 2 | 1 | 2 |
| c. | Which of these is/are not self management strategies?<br>a. Not able to complete the task which you aimed for<br>b. Time optimization<br>c. Think about the past and not make it practical to work for the future (ans)<br>d. Self respect | 4 | 2 | 4 |
| d. | During an internal exam, an engineering student notices a close friend copying answers using a mobile phone. What makes this situation an ethical dilemma?<br>a. Lack of exam supervision b. Pressure to score high marks<br>c. Conflict between academic integrity and personal loyalty d. Fear of punishment | 5 | 2 | 5 |
| Q2) | | | | |
| a | Self-management primarily refers to:<br>a. Controlling others' behavior<br>b. Managing time, emotions, and actions effectively<br>c. Obeying authority without question<br>d. Avoiding responsibility | 4 | 2 | 4 |
| b | A student avoids unnecessary consumption, saves energy in the hostel, and supports eco-friendly practices. Which stage/s of harmony is/are taken care of considering long-term sustainability mindset?<br>a. Self b. Family | 2 | 1 | 2 |

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|---|---|---|---|---|
| | c. Society d. Nature | | | |
| c | A student tops the semester but openly acknowledges the help of classmates and seniors. This behavior best reflects:<br>a. Self-confidence b. Humility<br>c. Righteousness d. Sympathy | 5 | 1 | 5 |
| d | Egolessness most directly contributes to harmony at which level first?<br>a. Self b. Society<br>c. Family d. Nature | 4 | 2 | 4 |
| Q3) | | | | |
| a. | Self-management differs from self-control because self-management emphasizes:<br>a. Immediate impulse control only<br>b. Long-term regulation through understanding and planning (ans)<br>c. External discipline<br>d. Fear of consequences | 5 | 2 | 5 |
| b. | What do values reflect?<br>a A person's immediate desires<br>b. A person's sense of right and wrong or what 'ought' to be<br>c. A person's external influences | 1 | 2 | 1 |
| c. | Ethics are often professional and legal guidelines<br>a. True b. False | 2 | 1 | 2 |
| d. | A value-based work culture in a hostel is best sustained by:<br>a. Tolerance b. Harmony<br>c. Self resistance d. Integrity | 2,5 | 1 | 2,5 |
| Q4) | | | | |
| a | A humble person primarily demonstrates<br>a. Fear of failure b. Dominance over others<br>c. Awareness of personal limitations d. Silence in all situations | 2 | 1 | 2 |
| b | Which behavior BEST reflects humility in a group project?<br>a. Taking credit for team success<br>b. Ignoring others' ideas<br>c. Acknowledging team contributions<br>d Remaining silent during discussions | 1 | 2 | 1 |
| c | A student feels sorry for an injured lab partner but avoids helping due to inconvenience. This reaction mainly shows<br>a. Empathy b. Sympathy<br>c. Integrity d. Righteousness | 1 | 2 | 1 |
| d | A hostel roommate follows a different daily routine that causes minor inconvenience to his/her peers. Which virtue best shows adjusting expectations and communicating respectfully?<br>a Tolerance b. Self-control<br>c. Integrity d. Humility | 2 | 2 | 2 |
| Q5) | | | | |
| a | Which of the following is NOT a characteristic of humility?<br>a. Willingness to learn b. Respect for others<br>c. Ego-driven behavior d. Acceptance of feedback | 1 | 2 | 1 |

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|---|---|---|---|---|
| b | During a difficult semester, a group of engineering students study together, share notes, and motivate each other without expecting any personal gain. This behavior best reflects:<br>a. Friendship b. Competition<br>c. Comradeship d. Sympathy | 1 | 2 | 1 |
| c | Sympathy means:<br>a. Feeling sorry for others b.Ignoring others' feelings<br>c. Understanding others' emotions d.Putting yourself in others shoes | 5 | 1 | 5 |
| d | Integrity is connected in an important way to acting morally.<br>a. True b. False | 5 | 1 | 5 |
| Q6) | | | | |
| a | Which of the following shows comradeship?<br>a. A student helps only close friends with notes but ignores others in the group.<br>b. Students enjoy spending free time together, but avoid academic collaboration.<br>c. In a hostel, students from different batches support each other during exam stress, even without personal closeness.<br>d. Supporting someone due to emotional closeness | 5 | 1 | 5 |
| b | Tolerance primarily involves:<br>a. Agreeing with everyone b. Avoiding people<br>c. Respecting differences d .Suppressing emotions | 5 | 1 | 5 |
| c | Which of the following does not show egolessness?<br>a. Having a feel of defeating everything rather than doing best<br>b. Feeling jealous of others' performance<br>c. Getting less personal about things<br>d. Knowing that you are not the best | 1 | 2 | 1 |
| d | Harmony in life means:<br>a. Absence of problems b.Balance at all levels<br>c. Ignoring conflicts d. Following rules blindly | 1 | 1 | 1 |
| Q7) | (10 marks) | | | |
| a | Define Comradeship. Explain the qualities required for a good comradeship. | 5 | 2 | 5 |
| | **OR** | | | |
| b | Imagine you were in a situation where someone in your family was extremely ill. Your relative's doctor says that there is an experimental medicine that might help your loved one, expressing that it is the only thing that might work. Your family has very limited financial means. The medication costs 1 lakh per month and health insurance will not cover the cost. Q1) Mention the ethical dilemmas faced by you. Q2) Justify your decision making using the four warning signs Q3)Mention the set of virtues you should have in you while tackling the ethical dilemma/s. | 1 | 3 | 1 |