Form A : Paper-setting Blank Ref. No. ...*EX/CE/T/126//2019(Old)*

.....*B.E Civil Engineering 1st Year*... EXAMINATION, *2019(Old)*
(~~1st~~ / 2nd Semester / ~~Repeat~~ / ~~Supplementary~~ / ~~Annual / Bi-Annual~~)

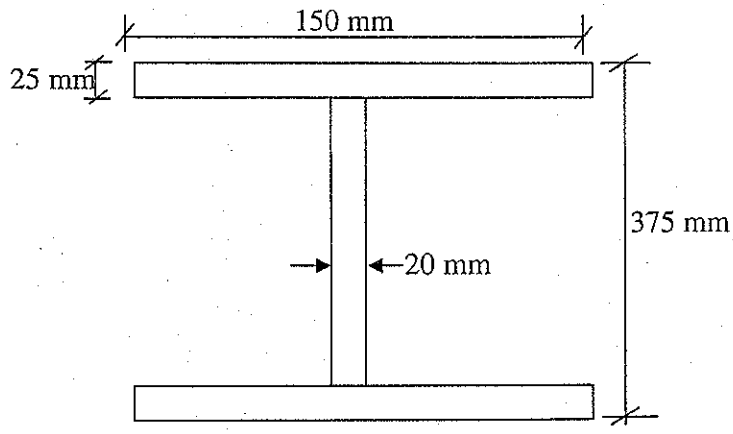
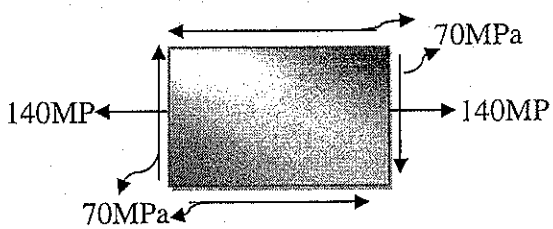
SUBJECT .....*Structural Mechanics - I*
( Name in full )

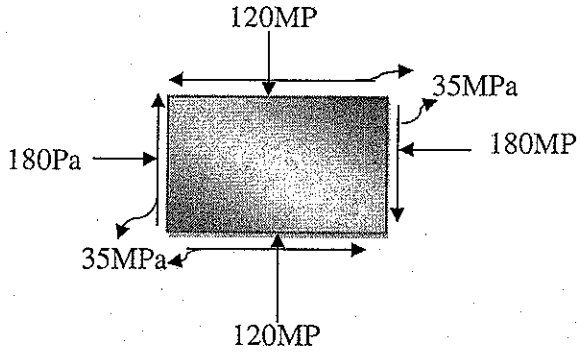
PAPER .....*XX*.....

Full Marks 100
(60 marks for part I)

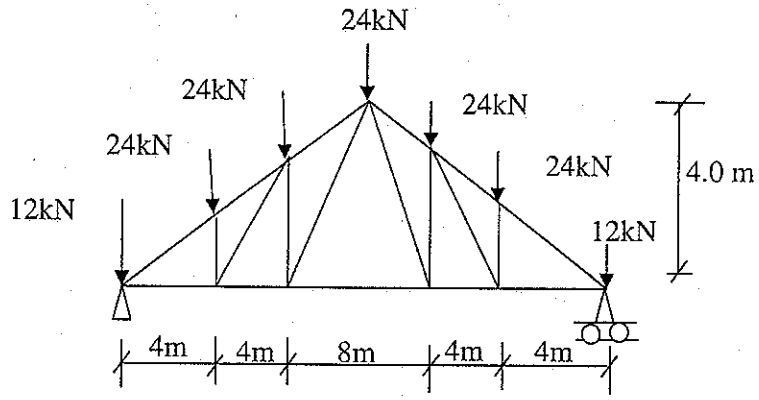
Time: ~~Two hours~~/Three hours/~~Four hours/Six hours~~

Use a separate Answer-Script for each part

| No. of Questions | PART I | Marks |
|---|---|---|
| | **Answer any three questions** | |
| 1. | a) A circular log of wood is used as a beam. If the radius of the log is 125mm, find the moment of resistance of the section. Permissible stresses are 9MPa in tension and 12MPa in compression. | 8 |
| | b) Draw the shear stress distribution diagram for I-section given below. The section is subjected to a shear force of 625kN. Also find the maximum shear stress and the location where the maximum shear stress occurs.   | 12 |
| 2. | a) Draw the Mohr's circle for the stress element given bellow. From this Mohr's circle find the stresses on the plane whose normal is inclined at $+60^0$ to the positive X-axis. Also find the principal stresses and planes on which they act.   | 12 |
| | b) The stress system on an element of a stressed body is shown in figure bellow. Determine the planes on which there is no shear stress. What are the stresses acting on these planes? | 8 |




3. Determine the force in each member of the roof truss shown in figure given bellow. State if the members are in tension or compression. 20




4. a) State the assumptions of pure bending. Also prove $\frac{M}{I}=\frac{\sigma}{y}=\frac{E}{R}$, the notations have their usual meaning. 12

b) Show that for rectangular section, $\tau_{max}=1.5\tau_{av}$, where $\tau_{max}$ and $\tau_{av}$ are maximum shear stress and average shear stress respectively. 8

Form A: Paper –Setting Blank

Ref No. –Ex/CE/T/126/2019(old)

CIVIL ENGG. 1ST YEAR 2ND SEMESTER EXAM 2019 (old)

(~~1st~~/ 2nd-Semester ~~/ Repeat / Supplementary / Annual / Bianual~~)

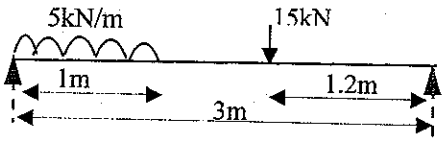
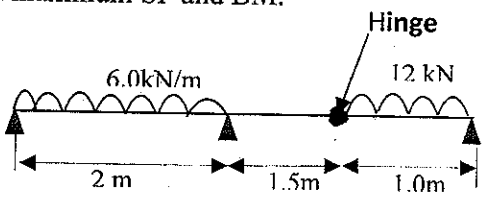
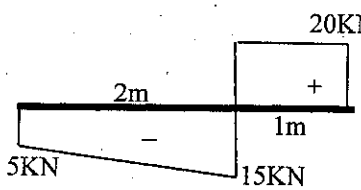
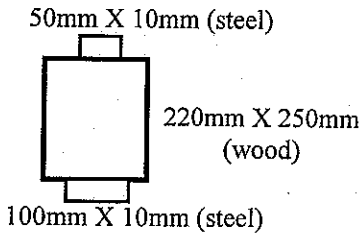
SUBJECT: Structural Mechanics-I

(Name in full)

Time: ~~Two hours~~/Three hours/~~Four hours/ Six hours~~

Full Marks 40

Use a separate Answer-Script for each part

| No. of Question | PART – II | No. |
|---|---|---|
| | **Answer any FOUR** | |
| 1. | Draw labeled SFD and BMD of the following simply supported beam loaded as shown in Figure 1. Also show the position and value of maximum SF and BM. | 10 |
| |  **Figure 1** | |
| |  **Figure 2** | |
| 2. | Analyze the hinged beam as shown in Figure 2 and draw labeled SF and BM diagram. Show the maximum bending moment and shear force values. | 10 |
| 3.i) | Explain stress-strain curve for mild steel bar indicating the salient points. | 4+6=10 |
| ii) | Figure 3 shows the SFD over an over-hanged beam as shown in figure 3. What can you say about the loading over this length? Draw the corresponding BMD. | |
| |  **Figure 3** | |
| |  **Figure 4** | |
| 4.i) | Find the ratio of shear modulus to the Young's modulus when poisson's ratio is 0.25. | 3+5=8 |
| ii) | Find equivalent steel section of the flitched beam as shown in the figure 4. Hence find maximum moment of resistance if the stresses in steel and wood are not to exceed 150 $N/mm^2$ and 7.5 $N/mm^2$ respectively. Given $E_s = 2x10^5 N/mm^2$ , $E_w = 1x10^4 N/mm^2$. | 2+(2+6)= 10 |
| 5. i) | Prove that, for pure torsion,<br>$\zeta/r = G\theta/L = T/J$<br>where, $\zeta$ = shear stress at radius r<br>G= Modulus of rigidity<br>$\Theta$= angle of twist<br>L=length of shaft<br>T= Torsional moment<br>J= Polar moment of Inertia | 6+4=10 |

| | | |
|---|---|---|
| ii) | A solid shaft of diameter 40 mm transmits a torque T= 45 T-m. If the same rod is transformed into a hollow shaft of thickness 4mm, keeping cross section area same, then how much torque will it transmit? | |