**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**
**(MID SEMESTER EXAMINATION MO/2024)**

**CLASS: B.TECH/ B.ARCH** **SEMESTER : V/ADD**
**BRANCH: CIVIL/ ARCHITECTURE** **SESSION : MO/2024**

**SUBJECT: CE301 STRUCTURAL DESIGN I**

**TIME: 02 Hours** **FULL MARKS: 25**

**INSTRUCTIONS:**
**1. The question paper contains 5 questions each of 5 marks and total 25 marks.**
**2. Attempt all questions.**
**3. The missing data, if any, may be assumed suitably.**
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates.**
**5. IS 456:2000 will be supplied to the candidates.**

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| Q.1(a) | Write advantages of concrete for construction of reinforced cement concrete structures. | [2] | 1 | K1 |
| Q.1(b) | Mention various loads and load combinations which are required to be considered in design of structures. | [3] | 3 | K1 |
| Q.2(a) | Draw the stress block with parameters for design of RCC members in flexure. | [2] | 3 | K1 |
| Q.2(b) | An RCC beam has width of 200 mm, effective depth of 400 mm, is reinforced with 3-16 mm diameter bars of Fe415 steel. Check whether the section is under-reinforced, balanced or over-reinforced and determine the moment of resistance of the beam using Limit State Method. Assume $f_{ck}$ = 20 N/mm$^2$. | [3] | 2 | K2 |
| Q.3(a) | Calculate the development length of 25 mm diameter steel reinforcement bar of Fe415 grade of steel under tension. Assume M20 grade of concrete. | [2] | 3 | K3 |
| Q.3(b) | Design a singly reinforced concrete beam of width 250 mm, subjected to an ultimate moment of 130 kN-m. Assume $f_{ck}$ = 20 N/mm$^2$ and $f_y$ = 415 N/mm$^2$. | [3] | 2 | K4 |
| Q.4(a) | A reinforced concrete beam of 4 m span requires 5 numbers Fe 415 bars of 20 mm diameter, as tension bars. Find the distance from the centre of the beam where the central bar can be curtailed. Assume $f_{ck}$ = 15 N/mm$^2$ and d = 300 mm. | [2] | 1 | K4 |
| Q.4(b) | A rectangular beam of size 250 mm width and 500 mm effective depth is reinforced with four bars of 25 mm diameter. Determine the required vertical shear reinforcement to resist the factored shear force of 300 kN. Consider M20 concrete and Fe415 steel. | [3] | 2 | K2 |
| Q.5(a) | A reinforced concrete beam of size 300 mm x 600 mm is subjected to a factored moment of 150 kN-m, factored shear force of 100 kN and factored torsional moment of 50 kN-m. Determine the equivalent shear force. | [2] | 3 | K2 |
| Q.5(b) | A T-beam with effective flange width of 950 mm and depth of flange of 120 mm. The effective depth of the beam is 580 mm width of web is 300 mm. It is reinforced with 8-20 mm diameter Fe 415 bars. Determine the ultimate moment of resistance of the section. Assume M20 grade of concrete. | [3] | 2 | K4 |

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