**SAMPLE QUESTION BANK**

**Program: Mechanical Engineering**

**Curriculum Scheme: Rev2019**

**Third Year, Semester VI**

**Course Code: MEC-601 and Course Name: Machine Design**

**Multiple Choice Questions: Sample Question Set**

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| **Choose the correct option for following questions. All the Questions carry equal**  **marks** | |
| 1. | Spring index is |
| Option A: | Its capability of storing energy |
| Option B: | Ratio of coil diameter to wire diameter |
| Option C: | Load required to produce unit deflection |
| Option D: | Indication of quality of spring |
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| 2. | The taper on cotter varies from |
| Option A: | 1 in 48 to 1 in 24 |
| Option B: | 1 in 32 to 1 in 24 |
| Option C: | 1 in 15 to 1 in 10 |
| Option D: | 1 in 24 to 1 in 20 |
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| 3. | In a cotter joint, the width of a cotter at centre is 50 mm and its thickness is 12 mm. If the load acting on the cotter is 60 KN, what is the shearing stress developed in the cotter? |
| Option A: | 50 N/mm2 |
| Option B: | 75 N/mm2 |
| Option C: | 100 N/mm2 |
| Option D: | 120 N/mm2 |
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| 4. | Guest's theory is used for |
| Option A: | Brittle materials |
| Option B: | Ductile materials |
| Option C: | Elastic materials |
| Option D: | Plastic materials |
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| 5. | When a close coiled helical spring is compressed, its wire is subjected to |
| Option A: | Tension |
| Option B: | Shear |
| Option C: | Compression |
| Option D: | Bending |
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| 6. | Two shafts ‘A’ and ‘B’ under pure torsion are of identical length and identical weight and are made of the same material. The shaft ‘A’ is solid and the shaft ‘B’ is hollow. We can say that |
| Option A: | Shaft B is better than shaft A |
| Option B: | Shaft A is better than shaft B |
| Option C: | Both the shafts are equally good |
| Option D: | Shafts are not of good quality |
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| 7. | A leaf spring in automobiles is used |
| Option A: | To apply forces |
| Option B: | To measure forces |
| Option C: | To absorb shocks |
| Option D: | To store strain energy |
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| 8. | The endurance or fatigue limit is defined as the maximum value of the stress which a polished standard specimen can withstand without failure, for infinite number of cycles, when subjected to |
| Option A: | Static load |
| Option B: | Dynamic load |
| Option C: | Static as well as dynamic load |
| Option D: | Completely reversed load |
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| 9. | Soderberg relation is based on \_\_\_\_\_\_\_\_\_\_ of the material whereas all other failure relation for dynamic loading are based on ultimate strength of the material. |
| Option A: | Elastic strength |
| Option B: | Yield strength |
| Option C: | Shear strength |
| Option D: | Endurance limit |
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| 10. | In forged components |
| Option A: | fiber lines are arranged in a predetermined way |
| Option B: | there are no fiber lines |
| Option C: | fiber lines of rolled stock are broken |
| Option D: | fiber lines are scattered |
|  |  |
| **11.** | In case of variable loading, the surface finish factor for the mirror polished specimen is taken as |
| Option A: | Zero |
| Option B: | One |
| Option C: | Two |
| Option D: | One and half |
|  |  |
| **12.** | Line joining Syt (yield strength of the material) on mean stress axis and Se (endurance limit of the component) on stress amplitude axis is called as |
| Option A: | Goodman line |
| Option B: | Soderberg line |
| Option C: | Gerber line |
| Option D: | Taylor line |
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| **13.** | A localised compressive stress at the area of contact between two members at rest is known as |
| Option A: | Shearing |
| Option B: | Compression |
| Option C: | Bending |
| Option D: | Crushing |
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| **14.** | In order to sustain axial load which type of bearing will be used? |
| Option A: | Deep groove ball bearing |
| Option B: | Thrust bearing |
| Option C: | Needle bearing |
| Option D: | Angular contact bearing |
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| **15.** | The diameter of a bearing designated by 6002 is |
| Option A: | 10 mm |
| Option B: | 12 mm |
| Option C: | 15 mm |
| Option D: | 17 mm |
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| **16.** | If six surfaces have friction lining, then number of disks required in multi disk clutch are |
| Option A: | Seven |
| Option B: | Eight |
| Option C: | Six |
| Option D: | Five |
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| **17.** | Multi plate clutch is used in two wheelers because |
| Option A: | Space in two-wheeler is less |
| Option B: | Cost of multi plate clutch is less |
| Option C: | It is easy to repair |
| Option D: | It is easy to design |
|  |  |
| **18.** | The friction material of the brake should have |
| Option A: | High endurance limit strength |
| Option B: | High coefficient of friction |
| Option C: | Low coefficient of friction |
| Option D: | Low endurance limit strength |
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| **19.** | Chain drive is used when distance between two elements is |
| Option A: | More |
| Option B: | Less |
| Option C: | Not a criterion |
| Option D: | Twice the sprocket diameter |
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| **20.** | The belt material in case of flour mill is |
| Option A: | Rubber |
| Option B: | Canvas |
| Option C: | Leather |
| Option D: | Composite |
| **21.** | A symbol Fe360 indicates a steel with |
| Option A: | Minimum Tensile Strength 360 N/mm2 |
| Option B: | Maximum Tensile Strength 360 N/mm2 |
| Option C: | Minimum shear Strength 360 N/mm2 |
| Option D: | Maximum shear Strength 360 N/mm2 |
| **22.** | The thickness of thick cylindrical shell with closed ends and made of brittle material is determined by |
| Option A: | Barlow’s equation |
| Option B: | Clavarino’s equation |
| Option C: | Birnie’s equation |
| Option D: | Lame’s equation |
| **23.** | A key way lowers |
| Option A: | the strength of the shaft |
| Option B: | the rigidity of the shaft |
| Option C: | both the strength and rigidity of the shaft |
| Option D: | the ductility of the shaft |
| **24.** | Flexible coupling is used because....... |
| Option A: | It is easy to disassemble |
| Option B: | It is easy to engage and disengage |
| Option C: | It transmits shocks gradually |
| Option D: | It prevents shock transmission and eliminates stress reversals |
| **25.** | A close-coiled helical spring of stiffness 30 N/mm is arranged in series with another such spring of stiffness 60 N/mm. The stiffness of composite unit is |
| Option A: | 20 N/mm |
| Option B: | 30 N/mm |
| Option C: | 45 N/mm |
| Option D: | 90 N/mm |
| **26.** | The shock absorbing capacity of bolt can be increased by making the shank diameter \_\_\_\_\_\_\_\_ the root diameter. |
| Option A: | Lesser than |
| Option B: | Equal to |
| Option C: | Greater than |
| Option D: | No effect |
| **27.** | Components made of brittle materials fails because of |
| Option A: | Sudden fracture |
| Option B: | Yielding |
| Option C: | Elastic deflection |
| Option D: | Gradual load |
| **28.** | For a shaft diameter of 100 mm, the number of bolts in a flange coupling should be |
| Option A: | 4 |
| Option B: | 6 |
| Option C: | 8 |
| Option D: | 10 |
| **29.** | A compound cylinder with inner radius 50 mm and outer radius 70 mm is made by shrinking one cylinder on to the other cylinder, The junction radius is 60 mm and the junction pressure is 1.1 N/mm2. The maximum hoop stress developed in the inner cylinder is |
| Option A: | 3.6 N/mm2 compression |
| Option B: | 3.6 N/mm2 tension |
| Option C: | 7.2 N/mm2 compression |
| Option D: | 7.2 N/mm2 tension |
| **30.** | When a shaft is subjected to a bending moment M and a twisting moment T, then the equivalent twisting moment is equal to |
| Option A: | M + T |
| Option B: | √ (M2 + T2) |
| Option C: | M2 + T2 |
| Option D: | √ (M2 - T2) |

**Descriptive Questions Sample Set**

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|  | Design a socket and spigot cotter joint to sustain the load of 35 KN. |
|  | What are the general considerations in machine design? |
|  | A helical compression spring made of oil tempered carbon steel wire is subjected to an axial load, which varies from 400 N to 1000 N. The spring index is 6. The endurance strength for repeated stress variation and the yield strength may be taken as 350 N/mm2 and 770 N/mm2 respectively. Determine i) the wire diameter ii) Spring diameter, for a factor of safety of 1.5. |
|  | A 600 mm diameter pulley driven by a horizontal belt drive transmits power through a solid shaft to a 250 mm diameter gear which drives a mating pinion which transmits torque in vertically downwards direction. The weight of the pulley is 1500 N The shaft transmits a power of 7.5 KW at 650 r.p.m. to the pulley which has horizontal drive. Belt tension in tight side is twice that of the slack side. Determine the shaft diameter by considering suitable material and stresses. Take shock and fatigue factor in shear and bending as 1.5 and 2 respectively. |
|  | A 50 mm diameter shaft is to be welded to a flat plate as shown in fig if the size of weld is 15 mm. Find the maximum normal and shear stress in weld. Find the maximum normal and shear stress in weld. |
|  | A single-row deep groove ball bearing is subjected to a 30 second work cycle that consists of the following two parts:    The static and dynamic load capacities of the ball bearing are 50 and 68 KN respectively. Calculate the expected life of the bearing in hours. |
|  | Design a open type flat belt drive for a compressor running at 720 rpm, which is driven by a 25 KW, 1440 rpm motor. Space is available for a centre distance of 3 m. |
|  | Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.15. Select suitable material and stresses. |
|  | A bracket is bolted to a column by 6 bolts of equal size as shown in Fig. It carries a load of 50 KN at a distance of 150 mm from the centre of column. Determine the diameter of bolt. |
|  | Design a screw jack to life a load of 120 KN. |
|  | A work cycle of a mechanical element is subjected to complete reversed bending stresses as follows:  a) ± 300 MPa for 30% of time b) ± 275 MPa for 25% of time c) ± 400 MPa for 10% of time d) ± 325 MPa for 25% of time e) No load for remaining time.  The material has ultimate tensile strength of 1200MPa. Operating temperature is 400°C and temperature factor may be taken as 0.5 Assume fatigue stress factor = 0.7. Determine the life of component. |
|  | A single dry plate clutch is to be designed to transmit 7.5 kW at 900 r.p.m. Find  1. Diameter of the shaft,  2. Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4,  3. Outer and inner radii of the clutch plate, and  4. Dimensions of the spring, assuming that the number of springs are 6 and spring index = 6.  The allowable shear stress for the spring wire may be taken as 420 MPa. |
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| 13. | A 3600 hydro dynamically lubricated journal bearing supports a load of 20 KN when operating at 1000 rpm for a steam turbine. Assuming bearing pressure of 1.6 N/mm2 and average clearance. Find diameter and the length of bearing, clearance ratio, minimum film thickness, viscosity of oil, coefficient of friction, friction power loss, operating temperature of oil, bearing surface temperature, oil flow rate and select type of lubricating oil to be used. Assume bearing to be self-contained. |
| 14. | A bracket is riveted to column by 6 rives of equal size as shown in fig it carries a load of 50 KN at a distance of 200 mm from the centre of column. If the maximum shear strength in the column is limited to 150 MPa. Determine diameter of Rivet. |
| 15. | A ball bearing mounted on shaft operates on the following load cycle.   |  |  |  |  | | --- | --- | --- | --- | | Sr. No | Radial Load, KN | Speed, rpm | Duration, sec | | 1 | 5 | 400 | 3 | | 2 | 8 | 550 | 4 | | 3 | 4 | 350 | 3 |   Select suitable bearing for a life of 10000 hours with 93% probability of survival. |
| 16. | Explain why taper is provided on cotter. What are the usual values of taper? |
| 17. | Describe ways to reduce stress concentration in any five elements. |
| 18. | What is surge in springs? How it can be avoided? |
| 19. | Explain the ergonomics considerations in design for shape and size. |
| 20. | Describe any five types of flat belt drive with suitable sketch. |
| 21. | Explain various belt drive with suitable sketch. |
| 22. | State the speciality of each type of ball bearing with suitable sketch |
| 23. | What are the types of screw used in power transmission? |
| 24. | What are the different theories of failures? Explain any one theory and draw its safe region. |
| 25. | Compare between anti friction bearing and sliding contact bearing |
| 26. | Explain Notch sensitivity and Endurance limit related to design of machine elements subjected to variable loads. |
| 27. | What is preferred number? Explain use of preferred number in engineering design? |
| 28. | Explain the nipping of the leaf spring with neat sketch. |
| 29. | What are the assumptions made in analysis of curved beam |
| 30. | What is self-locking and overhauling in screw? |