Code No: **R1631243** **R16** SET - 1

III B. Tech I Semester Supplementary Examinations, August – 2021

DESIGN OF MACHINE ELEMENTS

(Automobile Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A **(14 Marks)**

1 a) Enumerate the most commonly used engineering materials and state at least one important property and application of each. [3M]

b) What is the difference between a cotter and key? Why a single taper is provided in cotter and not on both sides? [2M]

c) List out the functions of structural springs. [2M]

d) Describe the purpose of gib in cotter joint. What are the applications of cotter joints? [2M]

e) Explain the effect of key-way on the strength of a shaft. [2M]

f) Discuss the function of coupling. Give at least three practical applications. [3M]

PART-B **(56 Marks)**

2 a) Discuss the importance of limits, fits and tolerances as per BIS Codes. [4M]

b) A shaft can transmit power of 20 KW at 1000 RPM. The actual torque transmitted by shaft is ± 60% of the mean torque calculated. Shaft is also subjected to a variable bending moment of 500 N-m to 1000 N-m. The maximum bending moment occurs at the same instant as that of maximum torque. Determine the diameter of the shaft required selecting suitable material. Take factor of safety 2, size factor = 0.85, and surface factor = 0.8. [10M]

3 a) A bolt in a steel structure is subjected to a tensile load of 9 KN. The initial tightening load on the bolt is 5 KN. Determine the size of the bolt taking allowable stress for the bolt material to be 80 MPa. [7M]

b) Determine the safe tensile, shear and bearing loads and the efficiency for a 300 mm section of single-riveted lap joint made from 6mm plates using six 16-mm diameter rivets. Assume that the drilled holes are 1.5 mm larger in diameter than the rivets. The values for the design limits for tensile, shear and bearing stress can be taken as 75, 60 and 131MPa, respectively. [7M]
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4 a) Classify the shaft couplings with suitable examples. [4M]

b) Design a bushed-pin type of flexible coupling to connect a pump shaft to a motor shaft transmitting 32 kW at 960 rpm. The overall torque is 20 % more than mean torque. The material properties are as follows: [10M]
The allowable shear and crushing stress for shaft and key material is 40 MPa and 80 MPa respectively.
The allowable shear stress for cast iron is 15 MPa.
The allowable bearing pressure for rubber bush is 0.8 N/mm^2.
The material of the pin is same as that of shaft and key

5 a) Draw a neat sketch of multi leaf spring and show its essential parts. Also explain nipping of leaf spring. Prove that it is designed as beam of uniform strength. [4M]

b) Design a helical spring for a spring loaded safety valve from the following data: [10M]
Valve diameter = 65 mm; Maximum pressure when the valve blows off freely = 0.75 N/mm^2; Valve lift when pressure rises from 0 .7 to 0.75 N/mm = 3mm; Maximum permissible stress in the material of the spring =500 N/mm^2; Spring index = 6; Modulus of rigidity of the spring material = 1×105 N/mm^2.

6 a) Distinguish the hydrostatic and hydro dynamics bearings. [4M]

b) Design a journal bearing for a centrifugal pump with the following data: [10M]
Diameter of the journal = 150mm
Load on bearing = 40KN
Speed of journal = 900rpm.

7 Design a cast iron piston for a single acting four stroke engine for the following data: [14M]
Cylinder bore = 100mm;
Stroke = 125mm;
Maximum gas pressure = 5N/mm^2;
Indicated mean effective pressure = 0.75 N/mm^2;
Mechanical efficiency = 80%;
Fuel consumption =0.15kg per brake power per hour;
Higher calorific value of fuel =42 x 10^3 kJ/kg; Speed = 2000r.p.m.
Any other data required for the design may be assumed.

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