

**B.Tech. MECHANICAL ENGINEERING
(BTMEVI)**

Term-End Examination

December, 2013

BIME-011 : MACHINE DESIGN-II

Time : 3 hours

Maximum Marks : 70

Note: *Attempt Five questions. Question No. 1 is compulsory. Use of Machine Design Data book, and scientific calculator is permitted. Assume missing data (if any) suitably.*

1. Select the most appropriate answer : **7x2=14**
- (a) Factor of safety for brittle materials is based on :
- (i) Yield point stress
 - (ii) Ultimate stress
 - (iii) Maximum sheet stress
 - (iv) None of these
- (b) Which of the following is used for designing ductile materials ?
- (i) Rankine's Theory
 - (ii) Guest's Theory
 - (iii) Saint Venant's Theory
 - (iv) None of these
- (c) Stress concentration factor is given by ratio of :
- (i) Yield point stress to maximum stress
 - (ii) Maximum stress to yield point stress
 - (iii) Maximum stress to nominal stress
 - (iv) Nominal stress to maximum stress

- (d) Herringbone gear are :
- (i) Spur gears
 - (ii) Single helical gears
 - (iii) Double helical gears
 - (iv) Bevel Gears
- (e) The bearing characteristic number for a bearing with following specification will be :
- $P = \text{bearing pressure} = 0.16 \text{ N/mm}^2$
 $Z = \text{Viscosity of lubricant} = 0.02 \text{ kg/m}^{-\text{s}}$
 $N = 1800 \text{ r.p.m}$
- (i) 5.625
 - (ii) 56.25
 - (iii) 22.5
 - (iv) 225
- (f) Ball bearing expressed numerically as 306 represents :
- (i) bearing of light series where bore is 15 mm
 - (ii) bearing of medium series where bore is 30 mm
 - (iii) bearing of medium series where bore is 18 mm
 - (iv) bearing of light series where bore is 30 mm
- (g) Pistons are made of :
- (i) cast iron
 - (ii) aluminium alloy
 - (iii) steel
 - (iv) any of the above
2. A pair of spur gears carefully cut with 20° involute teeth is to transmit 25 kW at 300 rpm of the gear at speed reduction of 5 : 1. The pinion should not be smaller than 76 mm in pitch diameter and is made of forged C - 30 steel. Select a suitable spur gear and determine module, number of teeth and face width of the gears. Take gear material is cast iron. 14

3. A pair of helical gears are to transmit 15 kW. The teeth are 20° stub in diametral plane and have a helix angle of 45° . The pinion runs at 10,000 r.p.m and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gear are made of cast steel having allowable static strength of 100 MPa ; determine suitable module and face width and check the gears for wear given $\Sigma \sigma_s = 618$ MPa. 14
4. A hardened steel worm rotating at 1250 rpm transmits 12 kW to a phosphor bronze gear with a transmission ratio 15 : 1. The centre distance is 225 mm and teeth have $14\frac{1}{2}^\circ$ FD involute form. Design the above. 14
5. Design a Journal bearing for a centrifugal pump from following data given : 14
 load on Journal = 20kN ; Speed of Journal = 900 rpm ; Type of oil is SAE 10, for which the absolute viscosity at $55^\circ = 0.017$ kg/m^{-s} ;
 Ambient temperature of oil = 15.5° ;
 Maximum bearing pressure for pump = 1.5N/mm^2 .
 Also calculate mass of lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C . Heat dissipation co-efficient = 1232 W/m²/°C.
6. Select a suitable ball bearing to carry a radial load of 10,000 N and an axial load of 4000 N. The shaft rotates at 1000 rpm. Average life is 5000 hours. Take mild shock. 14
7. (a) Discuss the design of connecting rod for four stroke petrol engine. 7+7=14
 (b) Name and explain the various types of stresses induced in crank-web.