

GUJARAT TECHNOLOGICAL UNIVERSITY
Diploma Engineering - SEMESTER – IV • EXAMINATION – WINTER 2012

Subject code: 340203**Date: 28/12/2012****Subject Name: Basic Automobile Design****Time: 02.30 pm - 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt any five questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. English version is considered to be Authentic.

- Q.1** (a) What is factor of safety? List various factors on which it depends. **07**
 (b) Explain following terms: **07**
 1. Young modulus 2. Shear modulus 3. Bearing stress
 4. Torsion stress

- Q.2** (a) Explain the design criteria of piston **07**
 (b) Design a cast iron piston for given data **07**
 Bore diameter = 25 cm, stroke = 30 cm, engine speed = 500 rpm
 Maximum explosion pressure = 45 kg/cm²
 Permissible Stress = 450 kg/cm² for piston
 Permissible Stress = 1000 kg/cm² for piston rings
 Radial wall pressure = 0.4 kg/cm²
 Permissible bearing pressure for pin = 200 kg/cm²
 Permissible bending stress in pin = 600 kg/cm²

OR

- (b) Find piston head thickness and pin dimensions for 4 stroke engine from **07**
 following data.
 Cylinder bore: 240mm, Stroke : 300mm, engine speed = 450 rpm
 Max. gas pressure : 5 N/m²,
 IMEP: 0.8 N/m², Mech. Efficiency : 72%,
 Fuel consumption : 0.24 x 10⁻³ kg/watt/Hr, HCV : 43680 KJ/kg,
 Speed: 450 rpm, C = 0.05, k = 0.0466 W/mm/°C, T_c-T_e = 220 °C,
 Bending Stress on pin : 110 N/mm² Take l/d = 1.5.

- Q.3** (a) Explain the forces acting on connecting rod **07**
 (b) Find the dimension of I-section of connecting rod from following **07**
 data.
 Mass of reciprocating parts : 2.5 kg, Engine speed : 2000 rpm
 Length of connecting rod : 250 mm, Stroke : 120 mm
 Cylinder bore : 80 mm, Factor of safety : 6
 Max. Explosion pressure : 35 kg/cm², a = 1/7500
 Crushing stress : 700 kg/cm². Take 4t*t*5t section.

OR

- Q.3** (a) Why I-section is preferred for connecting rod? **07**
 (b) Find the diameter of connecting rod, if length of the connecting rod **07**
 for slow speed diesel engine is 300 cm, cylinder diameter 110 cm
 and stroke 140 cm. Maximum gas pressure 60 kg/cm², Factor of
 safety = 20, E = 2.1 x 10⁶ kg/cm²

- Q.4** (a) Explain the main design criteria for crank- shaft. **07**
 (b) Design a cast iron flywheel to store 70,000 kgm of energy at 200 rpm. **07**
 The radius of gyration is 140 cm. Calculate weight and thickness of the rim, if width is 40 cm. Assume 90 % of the energy is stored in the rim. The density of the material is $7.25 \times 10^{-3} \text{ kg/cm}^3$.

OR

- Q.4** (a) Explain the fluctuation of energy, fluctuation of speed and turning moment diagram of the flywheel. **07**
 (b) The scales for the turning moment diagram for an engine are as follow. **07**
 Turning moment: 1cm= 650 kg-cm and Crank angle:1cm = 20° The areas of turning moment diagram for 1 revolution of multi cylinder engine with reference to mean turning moment below and above lines are -0.32,+4.08, -2.67, +3.33, -3.1, +2.26, -3.74, +2.6, and -2.44 cm^2 . The mean speed is 300 rpm with percentage speed fluctuation $\pm 1.5 \%$. Diameter of flywheel 176 cm than determine cross – section of the flywheel if density of material is 0.0072 kg/cm^3

- Q.5** (a) Define (i) Gear Ratio (ii) Module (iii) Diametral pitch (iv) Pitch Circle diameter **07**
 (b) The gear ratios for a car are: 1st gear 3.9: 1, 2nd gear 1.85: 1. Top gear = 1:1. Constant ratio of differential = 5.6. Determine the speed of car in each gear if engine RPM is 4200 and effective wheel diameter is 78 cm. **07**

OR

- Q.5** (a) Explain the requirement of clutch. **07**
 (b) A single plate clutch both side effective is to transmit 18 HP at 1200 rpm. The ratio of outer diameter to inner diameter is 1.4, coefficient of friction as 0.3 and maximum intensity of pressure is 0.9 kg/cm^2 . Assuming UWC find diameters of friction surfaces and axial thrust. **07**

;}RGF:

1. TDFD 5F\R 5||`GMGF HJFA OZHLIFT K[.
2. H~Z H6FI tIF\ IYFIMuI WFZ6FVM AF\WJL.
3. HD6L AFH] NX¶FJ{, VF\S0F 5||`GMGF 5}ZF U]6 NX¶FJ[K[.
4. V\U|[HL 5+ VFWFZE}T U6FX[P

5|`Gv V O[S8Z VMO X[O8L X)\ K[m T[X[GL 5Z VFWFZ ZFB[K[P 07
!
A GLR[GF 5NM ;DHFJMP 07
! IU DM0I],;4 Z IXIZ DM0I],;4 # A[ZL\U :8=[;4 \$ 8MX"G :8=[;

5|`Gv V l5:8G 0LhF.GGF S|F.8[ZLIF ;DHFJMP 07
Z
A GLR[GL DFCLTLG[VFWFZ[SF:8 VFIG" l5:8GGL l0hF.gF 07
SZMP
l;Lg0Z AMZ o 25 ;[PDL P4 :8=MS o 30 ;[PDL P4 V[lgHG :5L0 o 500 rpm4
JFI]G\] JW]DF\ JW] NAF6 o 45 kg/cm²
5ZDLl;A, :8=[; o 450 kg/cm² l5:8G DF8[
5ZDLl;A, :8=[; o 1000 kg/cm² l5:8G DF8[
Z[0LI, JM, 5|[XZ o 0.4 kg/cm² [
l5:8G 5LG DF8[5ZDLl;A, A[ZL\U 5|[XZ o 200 kg/cm² [
l5:8G 5LG DF8[5ZDLl;A, A[0L\U :8=[; o 600 kg/cm² [
VYJF

A GLR[GL DFCLTLG[VFWFZ[SF:8 VFIG" l5:8GGF C[0GL HF0F. 07
VG[l5GGM jIF; XF[WMP
l;Lg0Z AMZ o 240 mm4 :8=MS o 30 mm, V[lgHG :5L0 o 450 rpm4
JFI]G\] JW]DF\ JW] NAF6 o 5 N/m²
IMEP:0.8 N/m², DLS[GLS, 1FDTF o 72 %
OI], J5ZF; o 0.24 x 10⁻³ kg/watt/Hr, HCV : 43680 KJ/kg,
C = 0.05, k = 0.0466 W/mm/°C, T_c - T_e = 220 °C,
l5:8G 5LG DF8 A[0L\U :8=[; : 110 N/mm², l/d = 1.5.

5|`Gv #
V SG[S8L\U ZM0 5Z ,FUTF A/M ;DHFJMP 07
A SG[S8L\U ZM0 DF8[GLR[GL DFCLTL 5ZYL I-;[SXGGL 07
0LhF.G SZMP
AMZ jIF; o 80 mm4 :8=MS o 120 mm, V[lgHG :5L0 o 2000 rpm4
Z[L5]MS[8L\U EFUMG]\ JHG o 2.5 kg4
SG[S8L\U ZM0GL ,\AF. o 25 cm4
DC;D V[S;% ,MhG 5|[XZ o 35 kg/cm²
DC;D :8=[; : 700 kg/cm², 4t*t*5t section ,M.
VYJF

5|`Gv #
V SG[S8L\U ZM0 DF8[I-;[SXG XF DF8[5;\N SZJFDF\ VFJ[K[m 07
A WLDL UTLGF\ 0Lh, V[lgHG DF8[SG[S8L\U ZM0GL ,\AF. 300 07
cm4 l;Lg0ZGM jIF; 110 cm VG[:8=MSGL ,\AF. 140 cm K[P HM
JFI]G\] JW]DF\ JW] NAF6 60 kg/cm² CMI4 TM
SG[S8L\U ZM0GM jIF; XMWMP FS = 20, E = 2.1 x 10⁶ kg/cm²

5)`Gv
\$

V S|[gS ;FO8 DF8[GF D]bI 0LhF.GGF S|F.8[ZLIF ;DHFJMP 07
A 200 rpm GL h05[70,000 kgm XlSTGM ;\U|C SZTF\ SF:8 07
VFIG"GF\ O,FIjCL,GL 0LhF.G SZMP UFIZ[XGGL +LHIF 140
cm K[P HM ZLDGL 5CM/F. 40 cm CMI TYF 90 % XSTLGM
;\U|C ZLDDF\ YTM CMI TM ZLDG]\ JHG VG[HF0F. XMWMP
O,FIjCL, D8LlZI,GL 0[lg;8L 7.25 x 10⁻³ kg/cm³ K[
VYJF

5)`Gv
\$

V O,FIjCL,G)\ OSrI]V[XG VMO V[GÒ" 4 OSrI]V[XG VMO :5L0 07
VG[8GL"U DMD[g8 0FIFU|FD lJQF[;DHFJMP
A V[lgHG DF8[8GL"U DMD[g8 0FIFU|FD DF8[GM :S[, GLR[07
D]HA K[P
8GL"U DMD[g8 : 1cm= 650 kg-cm and S|[gS V[gU, :1cm = 20°
V[S lZJM<I]XG NZdIFG 8GL"U DMD[g8 0FIFU|FDGF\
V[ZLIFVM H[DLG 8GL"U DMD[g8 ,F.GGL p5Z TYF GLR[
VFWFZ ,.G[D[/J[, K[T[-0.32,+4.08, -2.67, +3.33, -3.1, +2.26, -
3.74, +2.6, VG[-2.44 cm² K[P DLG :5L0 300 rpm K[PH[DF\ ± 1.5
% OSrI]V[XG ;EJLT K[P O,FIjCL,GM jIF:F 176 cm K[P T[DH
T[GL 3GTF 0.0072 kg/cm³ 4 TM VF S|M; ;[SXGGF\ DF5
XMWMP

5)`Gv
5

V JIFbIF VF5MP !P ULIZ Z[XLIM4 ZP DF[0I],4 #P 0FID[8=, 5LR4 07
\$P 5LR ;S", 0FIFDL8Z
A V[S SFZDF\ ULIZ Z[XLIM 1st gear 3.9: 1, 2nd gear 1.85: 1. Top 07
gear = 1:1 K[P 0LOZgXLI, Z[XLIM 5.6 K[P HM 5{0FGM
V;ZSFZS jIF; 78 cm VG[V[lgHGGL :5L0 4200 rpm CMI TM
NZ[S ULIZDF\ JFCGGL h05 XMWMP
VYJF

5)`Gv
5

V S,RGL H~lZIFT ;DHFJMP 07
A V[S l;U, %,[8 S,RGL A\G[AFH] V;ZSFZSTF K[P T[GL 1FDTF 07
1200 rpm 5Z 18 HP GL K[P V[l1FI, 5|[XZ 0.9 kg/cm² K[P HM
lO||SXG ;5F8LGM ACFZGM jIF; V\NZGF jIF; SZTF\ 1.4 U6M
JWFZ[CMI TM lO|SXG ,F.GL\UGF\ DF5 VG[V[l1FI, A/
XMWMP %,[8GM 3QF"6FS 0.3 K[P I]GLOMD" lJIZ Sg0LXG
