(56) 29/5/17

TE - Sem - V - CBSGS - Mechanical

Q. P. Code : 600701

(3 Hours) **Max. Marks: 80**

Note:

1. Question No.1 is compulsory.
2. Solve any 3 from remaining 5 questions.
3. Total No. of questions to be attempted are **Four**
4. Assume suitable data, if necessary.

Q1

a) What is octane number and cetane number? 5

b) Explain CRDI and MPFI in brief. 5

c) State True or False and Justify, that, "The SI Engine is quality governed and CI Engine is quantity governed." 5

d) Willan's line method of calculation of F.P. is best suitable for SI or CI Engine and why? 5

Q2

a) Write the requirements of 10
a) Fuel injection systems of CI Engines b) Ignition systems in SI Engines.

c) An 8-cylinder, four-stroke engine of 9 cm bore and 8 cm stroke with a compression ratio of 7 is tested at 4500 rpm on a dynamometer which has 54 cm arm. During a 10 minutes test the dynamometer scale beam reading was 42 kg and the engine consumed 4.4 kg of gasoline having a calorific value of 44000 kJ/kg. Air 27 ^{0}C and 1 bar was supplied to the carburettor at the rate of 6 kg/ min. 10
Find (i) the brake power delivered (ii) the brake mean effective pressure (iii) the brake specific fuel consumption (iv) the brake specific air consumption (v) the brake thermal efficiency (vi) the volumetric efficiency and (vii) the air-fuel ratio.

Q3

a) An experimental four-stroke gasoline engine of 1.7 litre capacity is to develop maximum power at 5000 revolutions per minute. The volumetric efficiency is 75% and the air fuel ratio is 14:1. Two carburettors are to be fitted and it is expected that at maximum power the air speed at the choke is 100 m/s. The coefficient of discharge for the venture is assumed to be 0.80 and that of main jet is 0.65. An allowance should be made for emulsion tube, the diameter of which can be taken as 1/3 of choke diameter. The gasoline surface is 6mm below the choke at this engine condition. Calculate the sizes of a suitable choke and main jet. The specific gravity of the gasoline is 0.75. p_a and T_a are 1 bar and 300 K respectively. 10

b) Explain (any two) of the following: 10
a) Engine Pollution and the NORMS.
b) Alternative fuels
c) Losses considered in Fuel-Air cycle

[TURN OVER]

Q4

a) A four-cylinder, four-stroke diesel engine develops a power of 180 kW at 1500 rpm. The *b.s.f.c.* is 0.2 kg/kWh. At the beginning of injection pressure is 30 bar and the maximum cylinder pressure is 50 bar. The injection is expected to be at 200 bar and maximum pressure at the injector is set to be about 500 bar. Assuming the following: C_d for injector = 0.7 , *S.G.* for fuel = 0.875 , Atmospheric pressure = 1 bar, Effective pressure difference = Average pressure difference over the injection period Determine the total orifice area required per injector if the injection takes place over 15^0 crank angles. 10

b) Draw and explain the stages of combustion in SI engine and the effect of various Engine parameters on combustion. 10

Q5

a) A test on a two-stroke engine gave the following results at full load: 10

Speed = 350 rpm
Net brake load= 65 kg
mep= 3 bar
Fuel consumption= 4 kg / h
Jacket cooling water flow rate = 500 kg / h
Jacket water temperature at inlet = 20^0 C
Jacket water temperature at outlet = 40^0 C
Test room temperature = 20^0 C
Temperature of exhaust gases = 400^0 C
Air used per kg of fuel = 32 kg
Cylinder diameter = 22 cm
Stroke = 28 cm
Effective brake diameter = 1 m
Calorific value of fuel = 43 MJ /kg
Proportion of hydrogen in fuel = 15 %
Mean specific heat of dry exhaust gas = 1 kJ/kg K
mean specific heat of a steam = 2.1 kJ/ kg K
Sensible heat of water at room temperature= 62 kJ/ kg
Latent heat of a steam = 2250 kJ/ kg

Find ip,bp and draw up a heat balance sheet for the test in KJ/min and in percentage.

b) With the help of a sketch explain in **short** the working of carburettor having following arrangements 06
i) Compensating jet ii) Idling Jet

c) With suitable example/values, prove that, during the Load test of an engine increase in the load increases the mechanical efficiency of the engine. 04

[TURN OVER]

Q6	Explain any four of the following **(any four)**	
a)	Supercharging of IC Engine	5
b)	Swirl and its types	5
c)	Requirements of cooling and Lubrication system.	5
d)	Detonation or knocking in SI Engine Vs in CI Engine.	5
e)	The Pollution control treatments of Exhaust gases of Engine.	5

TE- Sem-V - Mech - CBSG

23/5/17

(21)

T3525 / T0477 MECHANICAL MEASUREMENT AND CONTROL

Q.P. Code : 600601

(3 Hours) **[Total Marks : 80**

N. B. : (1) Question No.1 is **compulsory**.
(2) Attempt any **three** questions out of remaining **five** questions.
(3) Figures to right indicate full marks.
(4) Assume suitable data if **necessary**.
(5) Notations carry usual meaning.

1. (A) What are "Desired", "Modifying" and "Interfering" inputs for an instrumentation system? Draw block diagram for showing their influence on the output. **8**
   (B) Define the following terms with reference to the state space modelling of the system. **6**
   (a) State space (b) State variables
   (C) Explain the following terms with reference to static characteristics of the measuring instruments. **6**
   (a) Hysteresis (b) Drift

2. (A) What is mathematical modeling? Explain the importance of mathematical modelling in control systems. **6**
   (B) With a neat sketch explain the working of strain gauge based accelerometer. **6**
   (C) Obtain the state-space equation and output equation for the system defined by the equation, **8**

$$\frac{Y(s)}{U(s)} = \frac{2s^3 + s^2 + s + 2}{s^3 + 4S^2 + 5s + 2}$$

3. (A) With a neat sketch explain the constructional feature and working of (i) Thermistors. (ii) Ultrasonic Flow meter. **10**

   (B) For a system having $G(s) = \frac{15}{(s+1)\ (s+3)}$, $H(s) = 1$, determine **10**

   (i) Characteristic equation
   (ii) ω_n and damping ratio (ξ)
   (iii) Time at which Ist overshoot will occur
   (iv) Time period of oscillations
   (v) No. of cycles output will perform before settling down

[TURN OVER

4. (A) What are different temperature compensation techniques used in the measurement of strain using strain gauges? Explain any two methods in detail. **10**

   (B) For a system havmg G(s) H(s) $\frac{K(1+s)^2}{s^3}$, find range of values of "K" for system to be stable, using Routh's array. **10**

5. (A) For a certain feedback system having, **10**

   G(s) H(s) = $\frac{3(s+1)(s+6)}{s^2(s^2+18s+400)}$, Sketch Bode plot and comment on G.M., P.M and stability.

   (B) With a neat sketch explain the constructional feature and working of (i) McLeod gauge and (ii) Pyrometers. **10**

6. (A) For a umty feedback system havmg G(s) = $\frac{100(s+1)}{s^2(s+2)(s+10)}$, determme **10**

   (i) Type of system (ii) Error coefficients (iii) Steady state error for input as $1+4t+\frac{t^2}{2}$.

   (B) With neat sketches discuss significance of followings aspects of signal conditionings for any one of the sensor: amplification, conversion filtering, modulation/demodulation, and grounding. **10**

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(16)

TE-sem-V-CBSGS-Mech

5/6/17

Q.P. Code : 600800

(3 Hours) **Total Marks : 80**

Note : 1) Question **No.1** is **compulsory.**
2) Attempt **any three** questions from remaining six questions
3) Assume suitable data if required.
4) **Figures** to the **right** indicate **full** marks

1. (a) Cooling systems used in injection molds **20**
   (b) Laser Beam Machining
   (c) Indexing Mechanisms used in Jigs and Fixtures
   (d) Flexible Manufacturing System
   (e) Differentiate between Combination and Compound Die with diagram
   (f) Types of Automats

2. (a) Find the total pressure and dimensions of die & punch sets to produce a washer of 5.5 cm outside diameter with 2.5 cm diameter hole, from material 2 mm thick, having shear strength 350 N/mm^2. Take clearance 9% of stock thickness. **6**
   (b) What is Chemical Machining process? Explain in detail with the help of diagram. **6**
   (c) Discuss all sheet metal operations with help of diagrams. **8**

3 (a) Write short notes on the following: **10**
   (i) Six Point Location principle for Jigs and Fixtures.
   (ii) Drawing Press Tool for sheet metal.
   (b) Explain about any five types of Clamping elements with diagrams in detail. **10**

4 (a) Write about different types of transfer lines using neat sketches. **10**
   (b) What is agile manufacturing? Write about the components of Agile Manufacturing. **10**

5. (a) Explain the following: **10**
   (i) Design principles of clamping elements and any 3 types of locating elements.
   (ii) Abrasive Jet Machining.
   (b) What are the different elements of Ejection system in Injection Molds? Explain any one ejection method. **10**

6. (a) Write in detail about any five types of Jigs with neat sketches. **10**
   (b) Explain the following: **10**
   (i) Electrochemical Machining
   (ii) Plastic Injection Mold Standardization

TE-sem-V-Mech-CBSGS-TOM-VI

(33)

17/5/17

Q. P. Code : 600500

(3 Hours) [Total Marks : 80]

N.B. 1) Question No. 1 is **compulsory**

2) Answer any **Three** questions from remaining **Five**

3) Assume sutaible data wherever required, justify the same

4) Answer to questions showed be grouped and written together.

Qu. 1 Solve **any Four** (20)

a) What is the condition for self locking and self energizing of the belt?
b) Where and for what purpose a clutch is used? What are the different types of clutches? Explain the working of any one type of clutch.
c) Explain epicyclic gear train.
d) Define dynamically equivalent systems. State the condition necessary to make two systems dynamically equivalent.
e) Describe the gyroscopic effect on sea going vessels.
f) What is the function of governor? Classify governor.

Qu. 2 a) If capacity of a single plate clutch decreases by 13% during the initial wear period. determine the minimum value of ratio of internal diameter to external diameter for the same axial load. Consider both the sides of the clutch plate to be effective. (10)

b) The upper arm of porter governor are pivoted on the axis of rotation, their lengths being 30cm. the lower arms are pivoted on the sleeve at a distance 3 cm from the axis, their lengths being 27cm. Mass of each ball is 6 kg and the sleeve mass is 50 kg. Determine the equilibrium speed for a radius of rotation of 17 cm and also the effort and power for 1% change of speed. (10)

Qu. 3 a) A vehicle moves on a road that has a slope of 15^0. The wheel base and the Centre of mass at 0.72 m from the rare wheels and 0.8m above the inclined plane. The speed of the vehicle is 45 km/hr. the brakes are applied to all the four wheels and the coefficient of friction is 0.4. Determine the distance moved by the vehicle before coming to rest and the time taken to do so if it moves (i) up the plane (ii) down the plane. (10)

b) In a Hartnell governor, the radius of rotation of the balls is 60mm at the minimum speed of 240rpm. The length of the ball arm is 130mm and of the sleeve arm 80mm. the mass of each ball is 3kg and of the sleeve 4 kg. The stiffness of the spring is 20 N/mm. Determine (i) The speed when the sleeve is lifted by 50 mm. (ii) the initial compression of the spring. (iii) The governor effort. (iv) The power. (10)

[TURN OVER]

Qu. 4 a) Derive an expression for finding "angle of heel" of a two wheeler negotiating a turn. (10)

b) A cast iron flywheel is required to absorb 25000 N-m of energy as speed is increased from 120 to 125 rpm. If wheel is to be solid disc having a diameter 8 times the thickness. Determine its diameter. Density of C.I.=7200 kg/m^3. (10)

Qu. 5 a) A horizontal gas engine running at 200 rpm has a bore of 210 mm and a stroke of 420 mm. The connecting rod is 924 mm long and the reciprocating parts weigh 18 kg. when the crank has turned through an angle of 30^0 from the inner dead center, the gas pressures on the cover and the crank sides are 500 kN/m^2 and 60 kN/m^2 respectively. Diameter of the piston is 40mm. Determine (i) turning moment on the crank shaft. (ii) thrust on the bearings. (iii) acceleration of the flywheel which has a mass of 8 kg and radius of gyration of 600 mm while the power of engine is 22 kW. (10)

b) in an epicyclic gear train as shown in Fig. 1, the wheel C is keyed to shaft B and wheel F is keted to shaft A. the wheels D and E rotate together on a pin fixed to arm G. the number of teeth on wheels C, D, E and F are 35, 65, 32 and 68 respectively.
If the shaft A rotates at 60 rpm and shaft B rotates at 28 rpm in opposite direction, find the speed and direction of rotation of arm G. (10)

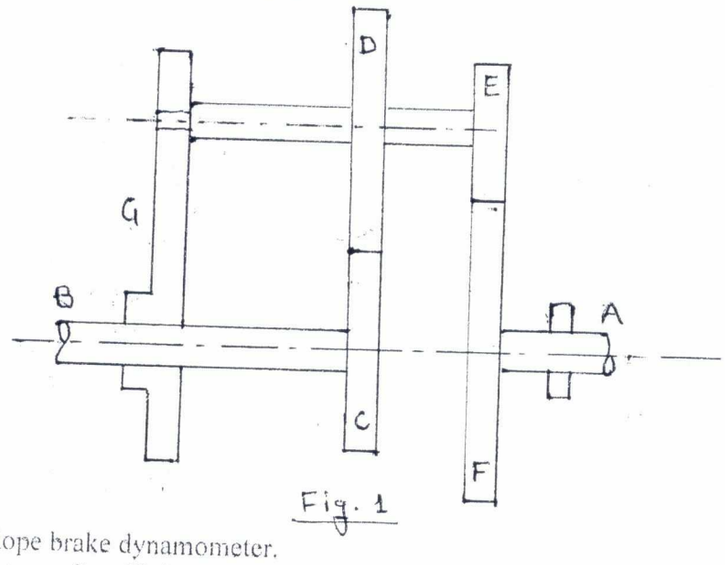

Fig. 1

Qu. 6 a) Explain Rope brake dynamometer. (05)
b) Write a note on Co-efficient of insensitiveness of governors. (05)
c) A multi-plate clutch transmits 55 KW of power at 1800 rpm. Coefficient of friction surface is 0.1. Axial intensity of pressure is not to exceed 160 kN/m^2. The internal radius is 80mm and is 0.7 times the external radius. Find the number of plates needed to transmit the required torque. (10)
