30/11/17

T.E - sem V - CBSGS - Mechanical - I.C Engine

Q. P. Code: 25265

Time: 3 hours **Marks: 80**

Notes: 1.Question No. 1 is compulsory
2. Solve any **THREE** from remaining **FIVE** questions.
3. Assume suitable data wherever necessary and state it clearly
4. Figures to the **RIGHT** indicates maximum marks

Q1 Attempt any **FIVE** of the following. (20)

a) Explain in brief the effect of increase in engine speed on angles of valve timing diagram?

b) Describe the effect of engine speed on spark intensity of battery ignition system.

c) Explain concept of quality governing and quantity governing.

d) What are the functions of cooling and lubrication system in engine?

e) With neat sketch explain exhaust gas recirculation

f) What are the advantages of Wankel Engine?

Q2 a) Write a note on essential properties of lubricants commonly used for engine lubrication. (8)

b) A simple carburettor is designed to supply 6 kg of air and 0.45 kg of fuel per minute to the 4 stroke single cylinder petrol engine. The ambient air is at 1.013 bar and 300 K with specific heat at constant pressure of 1000 J/kgK. Calculate the throat diameter of the venturi when the velocity of air is limited to 92 m/s. Take fuel density = 740 kg/m^3 and velocity coefficient = 0.8. If the pressure drop near the fuel nozzle is 75% of that at the venturi, calculate fuel nozzle diameter. Take discharge coefficient for fuel nozzle equal to 0.6. (12)

Q3 a) Compare supercharging and turbo charging on following factors: Drive, Control over exhaust, Special exhaust manifolds, Efficiency, Erosion and Injection timing modification (8)

b) During a test on a diesel engine the power developed by the engine is 42 kW. The fuel of 42600 kJ/kg calorific value is supplied to the engine at 0.187 kg/min. The air-fuel ratio was 18:1. The exhaust gases were passed through an exhaust gas calorimeter for which the observations were as follows: Water is circulated at 580 litres / hr, temperature rise of water through calorimeter is 36°C and temperature of exhaust gases at exit from calorimeter is 98°C. Ambient temperature is 20°C. Heat lost to cooling water jacket is 32% of the total heat supplied. If the specific heat of exhaust gases be 1.05 kJ / kg K, calculate heat balance sheet on min and percentage basis. (12)

Q4 a) With neat sketch explain stages of combustion in CI engine and state factors affecting ignition delay period. (10)

b) Explain design principles for SI engine combustion chamber. (10)

Q5 a) Compare detonation in SI and CI engine. (10)

b) What are the requirements of ignition system? With neat sketch explain high voltage capacitive discharge ignition system. (10)

Q6 a) The compression ratio of an engine working on an Otto cycle is 8. The initial condition of air is 1 bar and 373 K. The maximum pressure of the cycle is limited to 50 bar. Determine volume, pressure and temperature at all salient points of the cycle. Also find the ratio of heat rejected and heat supplied on the basis of one kg of air. (10)

b) Write short notes on **(Any two)** (10)

i) Octane and Cetane rating of fuels

ii) Variable compression ratio engine

iii) Difference between unit pump injector system and CRDi system

iv) Evaporative cooling system

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TE - Sem-V - CBSGS - Mechanical - MMC 24/11/17

Q.P.CODE: 25015

03 Hrs **[Total Marks 80]**

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

Q.1 (A) Derive an expression for steady state error when step and ramp input is given to the system. 8

(B) Define the following terms with reference to the state space modelling of the system. 06
(a) State space (b) State variables

(C) Explain the following terms with reference to static characteristics of the measuring instruments. 06
(a) Hysteresis (b) Drift

Q.2 (A) What is mathematical modeling? Explain the importance of mathematical modelling in control systems. 06

(B) Explain the construction, working and theory of thermal conductivity gauges for measurement of vacuum. Explain how radiation effects are minimized. 06

(C) Obtain the state-space equation and output equation for the system defined by the equation, 08

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

Q.3(A) Explain the construction and working of a d.c. tachogenerator. Explain its advantages and disadvantages. 10

(B) For a system having $G(s) = \frac{15}{(s+1)(s+3)}$, $H(s) = 1$, determine 10
(i) Characteristic equation (ii) $\omega_n$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

Q.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) Construct the block diagram that combines the following set of equations expressed in the "s" notations (Laplace notation). 10
(1) $W = X - Y$, (2) $V = W - Z$, (3) $Z(S + 6) = V(S + 2)$,
(4) $Y(S^2 + 6S + 8) = Z$, Given X is the input to the system and Y is the output from the block diagram. Find the transfer function.

Q.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 10
(i) Piezo- electric accelerometer and (ii) Pyrometers.

Q.6 (A) For a unity feedback system having $G(s)=\frac{100(s+1)}{s^2\,(s+2)(s+10)}$, determine 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

TE - Sem - V - Mechanical - CBSGS - PP - III

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8/12/17

Q.P. Code: 22327

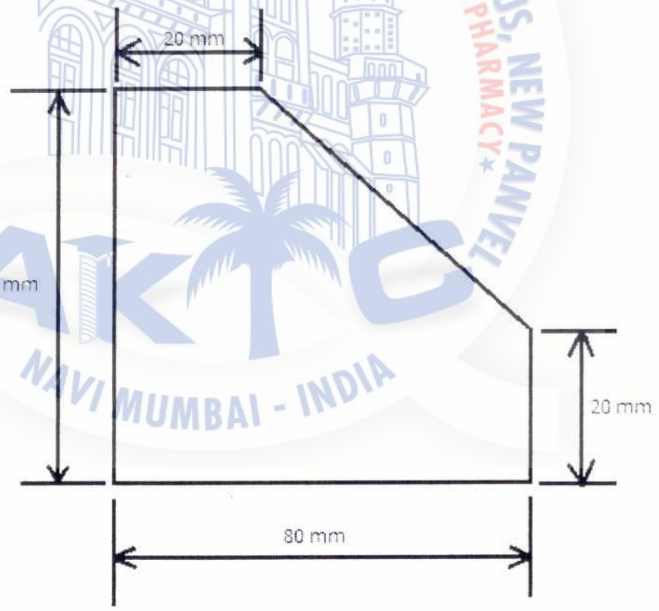
Time: 3 Hours **Marks: 80**

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

Q.1 Explain **any five**:- **20**

(a) Feeding systems used in injection molds
(b) Plasma Arc Machining
(c) Drill bushes used in Jigs
(d) IT/IS in Agile Manufacturing
(e) Differentiate between Blanking and Piercing with diagram
(f) SPM and its applications

Q.2 (a) Find the Center of Pressure of the component given below using suitable coordinate axis and also design the scrap strip layout, indicating important dimensions for the same. Also calculate length of strip for producing 60,000 blanks. **08**



(b) What is EBM process? Explain in detail with the help of diagram. **06**
(c) Explain about Indexing mechanisms used in Jigs and Fixtures. **06**

Q.3	(a)	Write short notes on the following: (i) 3-2-1 Location principle for Jigs and Fixtures. (ii) Drawing Press Tool for sheet metal.	10
	(b)	A deep drawing operation is used to make a cup of diameter 75 mm and length 65 mm and corner radius of 1.6 mm from C.R. steel sheet of thickness 1.7 mm. Calculate the blank size, percentage reduction, number of draws, punch and die radius, corner radius for punch and die, clearance and drawing pressure. Ultimate tensile strength is 400 N/mm^2, C = 0.67	10
Q.4	(a)	Write about different types of transfer lines using neat sketches.	10
	(b)	What are the different components of Agile Manufacturing? Explain in detail.	10
Q.5	(a)	Explain the following: (i) Design principles of clamping elements and any 2 types of clamping elements. (ii) Water Jet Machining.	10
	(b)	Explain with the help of neat sketch the working of two plate mold.	05
	(c)	Write about advantages and limitations of Hot Runner injection mold.	05
Q.6	(a)	Write in detail about different types of Milling fixtures and Turning fixtures with neat sketches.	10
	(b)	Explain the following: (i) Ultrasonic Machining (ii) Ejection System in Injection Molding machine	10

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TE - sem - V - mech - CBSGS

20/11/17

168

T3525 / T0476 THEORY OF MACHINES II

Q.P. Code: 22664

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

N.B. 1) Question No.1 is compulsory.
2) Attempt any three questions out of the remaining five questions.
3) Figures to the right indicate full marks.
4) Assume suitable data wherever required but justify the same.

Q1. Attempt any four **(20)**

A. Describe with a neat sketch a centrifugal clutch and deduce an equation for the total torque transmitted.

B. Explain the working of an internal expanding shoe brake.

C. What is stability of a governor? Sketch the controlling force versus radius diagrams for a stable, unstable and isochronous spring controlled governor.

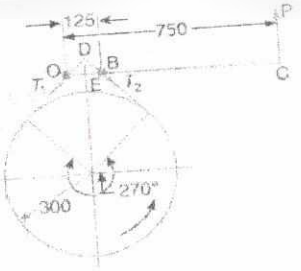
D. What will be the effect of the gyroscopic couple on a disc fixed at a certain angle to a rotating shaft?

E. Prove that maximum fluctuation of energy,
$\Delta E = E \times 2Cs$
Where, E = mean kinetic energy of the flywheel
Cs = coefficient of fluctuation of speed

Q2. A. A centrifugal clutch has four shoes which slide radially in a spider keyed to the driving shaft and make contact with the internal surface of a rim keyed to the driven shaft. When the clutch is at rest, each shoe is pulled against a stop by using a spring and leaves a clearance of 6 mm between the shoe and rim. The pull force exerted by the spring is 600 N. The C.G. of the shoe is 180 mm from the axis of the clutch. The internal diameter of the rim is 450 mm, stiffness of each spring is 50 kN/m. If the mass of each shoe is 10 kg and coefficient of friction between the rim and the shoe is 0.4, find the power transmitted by the clutch. Take speed of the shaft as 600 rpm. **(10)**

B. A simple band brake operates on a drum of 600 mm in diameter that is running at 200 rpm. The coefficient of friction is 0.25. The brake band has a contact of 270^0, one end is fastened to a fixed pin and the other end to the brake arm 125 mm from the fixed pin. The straight brake arm is 750 mm long and placed perpendicular to the diameter that bisects the angle contact. **(10)**

1) What is the pull necessary on the end of the brake arm to stop the wheel if 35 kW is being absorbed? What is the direction for this minimum pull?
2) What width of steel band of 2.5 mm thick is required for this brake if the maximum tensile stress is not to exceed 50 N/mm²?



{Turn Over}

Q3. A. A Hartnell governor having a central sleeve spring and two right angled bell crank levers moves between 290 rpm and 310 rpm for a sleeve lift of 15 mm. The sleeve arms and ball arms are 80 mm and 120 mm respectively. The levers are pivoted at 120 mm from the governor axis and mass of each ball is 2.5 kg. The ball arms are parallel to the governor axis at lower equilibrium speed. Determine i) Loads on the spring at the lowest and highest equilibrium speed ii) Stiffness of the spring. **(10)**

B. A four wheel car has a total mass of 3000 kg. Each wheel is of 450 mm radius. The center distance between two wheels on an axle is 1.5 m and wheel base is 2.5 m. The height of the C.G. is 0.5 m above the road surface and located at 1 m from front axle. Each wheel has moment of inertia of 32 kg-m^2. The engine axis is along the longitudinal axis of the vehicle. The engine rotates 4 times the speed of wheels in clockwise direction when viewed from front. The mass of rotating parts of engine is 70 kg having radius of gyration of 100 mm. If the car is taking a left turn of 70 m radius at 50 km/hr, find the ground reaction on each wheel. **(10)**

Q4. A In the epicyclic gear train as shown in figure, the driving gear A rotating in clockwise direction has 14 teeth and the fixed annular gear C has 100 teeth. The ratio of teeth in gears E and D is 98:41. If 1.85 kW is supplied to the gear A rotating at 1200 rpm, find: 1) the speed and direction of rotation of gear E and 2) the fixing torque required at C, assuming 100% efficiency throughout and that all teeth have the same pitch. **(10)**

B. Find the dynamically equivalent two mass system for a connecting rod when one third of the mass is located at the small end. Center of mass is at two third length from the small end and its moment of inertia is mL^2/20. **(10)**

Q5. A. The turning moment diagram for a multi cylinder engine has been drawn to a scale of 1 mm to 500 N-m torque and 1 mm to 6^0 of crank displacement. The intercepted areas between output torque curve and mean resistance line taken in order from one end, in sq. mm are - 30, +410, -280, +320, -330, +250, -360, +280, -260 sq. mm, when the engine is running at 800 rpm. The engine has a stroke of 300 mm and the fluctuation of speed is not to exceed ±2% of the mean speed. Determine a suitable diameter and cross section of the flywheel rim for a limiting value of the safe centrifugal stress of 7 MPa. The material density may be assumed as 7200 kg/m^3. The width of the rim is to be 5 times the thickness. **(10)**

B. Derive the equation for the stability of two wheeler taking a turn considering gyroscopic and centrifugal couple. **(10)**

Q6. Write short notes on:- **(20)**

A. Necessity of gear box
B. Wilson Hartnell governor
C. Froude hydraulic dynamometer.
D. Friction clutches.

T.E-sem-V - Mechanical - CBSGS - H.T 14/12/17

Q. P. Code: 27944

[3 Hours] [Total Marks: 80

N.B Question no.1 is compulsory.
Attempt any **THREE** from question no.2 to 6.
Use illustrative diagrams wherever possible.

Q1. **Solve any Four** (5*4)

(a) Define Thermal conductivity. Explain variation of thermal conductivity with respect to temperature of solid. liquid and gases.

(b) Explain Hydrodynamic and Thermal Boundary Layer.

(c) Define: Emissive power, Emissivity, Radiosity, Irradiation, Opaque body.

(d) Derive the equation of critical thickness of insulation.

(e) The radiation shape factor of the circular surface of thin hollow cylinder of 10cm diameter and 10 cm length is 0.1716. What is the shape factor of curved surface of cylinder with respect to itself?

Q.2 (a) A wall of a furnace is made up of inside layer of silica brick 120 mm thick covered with a layer of magnesite brick 240 mm thick. The temperature at inside surface of silica brick wall and outside surface of magnesite brick wall are 725°C and 110°C respectively. The contact thermal resistance between the two walls at the interface is 0.0035°C/W per unit wall area. If thermal conductivity of silica and magnesite bricks are 1.7 W/m°C and 5.8 W/m°C, calculate (08)

(i) The rate of heat loss per unit area of wall
(ii) The temperature drop at interface.

(b) Derive the expression for log mean temperature difference in a parallel flow heat exchanger. State yout assumption. (08)

(c) Explain Lumped heat capacity method with its assumption. (04)

Q.3 (a) Derive a relation of heat transfer through infinitely long fin. (08)

(b) In a counter flow double pipe heat exchanger using superheated steam is used to heat water at the rate of 10500 kg/h. The steam enters the heat exchanger at 180^0 C and Leaves at 130^0 C. The inlet and exit temperature of water are 30^0 C and 80^0 C respectively. If U = 814 W/m^2 ^{0}C, calculate the heat transfer area. What would be the increase in area if the fluid flows were parallel? (08)

TURN OVER

(c) Explain the physical significance of Nusselt number and Prandtl number. (04)

Q.4 (a) Show that the radiant heat transfer between two infinitely large parallel plates separated by n shields is (10)

$$Q_{n-shields} = \frac{A\,\sigma\,(T_1^4 - T_2^4)}{(n+1)[\frac{2}{\epsilon} - 1]}$$

(b) Air at 20°C is flowing over a flat plate which is 20 cm wide and 50 cm long. The plate is maintained at 100°C. Find heat loss from the plate if air is flowing parallel to 50 cm side with a velocity of 2 m/s. What will be the effect on heat transfer if the flow is parallel to 20 cm side? Take the following properties of air at 60°C (10)

k = 0.025 W/m^{0}C, Pr = 0.7, ν = 18.97 x 10^{-6} m^2/s,

$Nu_x = 0.664\,(Re_x)^{0.5}\,(Pr_x)^{0.33}$

Q.5 (a) Show by dimensional analysis for forced convection, Nu = ϕ(Re,Pr) (10)

(b) Calculate the net radiant heat exchange per m^2 area for two large parallel plates of temperature 427°C and 27°C respectively ε (hot plate)=0.9 and ε (cold plate) = 0.6.If a polished aluminum shield is placed between them, find the % reduction in heat transfer : ε (shield)=0.4 (07)

(c) Explain geometrical or shape factor. (03)

Q.6 (a) Write short note on(any Two) (08)

(i) Heat pipe
(ii) Various regimes in boiling heat transfer
(iii)Numerical methods and its application

(b) An egg with mean diameter of 4cm and initially at 20^{0}C is placed in a boiling water pan for 4 min and found to be boiled to the consumers taste. For how long should a similar egg for same consumer be boiled when taken from refrigerator at 5^{0}C? Take the following properties for egg: k = 10 W/mK, ρ = 1200 kg /m^3, C_p = 2 kJ/kg K and h = 100 W/m^2 ^{0}C. Use lump theory. (08)

(c) Explain the physical significance of Nusselt number and Prandtl number. (04)

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Correction : T0525 AND T3525 - HEAT TRANSFER QP Code : 27944

Please read question No. 6 (c) as follows :-

Explain the Physical Significance of Biot number and Grashoff number

instead of

Explain the Significance of Nusselt number and Prandtl number

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