Enrollment No……

Master of Technology

First Semester Main Examination, Dec-2020

ADVANCE MATHEMATICS [MTTPE101]

Time: 3:00 Hrs **Max Marks 70**

Note: (i) Attempt any five questions. All Question carry equal marks.

Q.1 Show that the geodesics on a plane are straight lines.

Q.2 Express $f(x) = x^4 + 3x^3 - x^2 + 5x-2$ in terms of Legendre polynomials.

Q.3 Solve in series the equation $9x(1-x)\frac{d^2-1}{dx^2} - \frac{12dy}{dx} + 4y = 0$

Q.4 A tightly stretched string of length *1* with fixed ends is initially in equilibrium position. It is set vibrating by giving each point a velocity $v_o \sin^{3217c}$. Find the displacement y(x,t)

Q.5 A covariant tensor has components $2x - z, x^2 y, yz$ in Cartesian co-ordinate system find its components in spherical co-ordinates.

Q.6 (a) Define Haar Transforms.
(b) Show that the Velocity of a Fluid at any point is a Covariant Tensor of order 1.

Q.7 Define Rank and Nullity of a Linear Transformation.

Q.8 Explain Markov Chain.

Enrollment No……

Master of Technology
First Semester Main Examination, Dec-2020
Thermodynamics and Combustion [MTTPE102]

Time: 3:00 Hrs **Max Marks 70**

Note: (i) Attempt any five questions out of eight.
(ii) All Question carry equal marks.

Q.1 (a) Explain different types of thermodynamic equilibrium.
(b) Explain local equilibrium conditions.

Q.2 (a) Define latent heat of vaporization and latent heat of sublimation.
(b) Write different statements of second law of thermodynamics.

Q.3 (a) State and prove the Pascal's law.
(b) Enunciate Newton's law of viscosity. Explain the importance of viscosity in fluid motion.

Q.4 (a) Define triple point and critical point.
(b) Write properties (P, V, and T) of water at triple point.

Q.5 (a) Discuss properties and structures of pre-mixed and diffusion flames.
(b) Classify gas burners. Also discuss FBC.

Q.6 (a) Write down Vander Waal's equation and derive equations for evaluation of its constants.
(b) State and prove law of corresponding states.

Q.7 (a) Explain with examples P-V diagram reversible and irreversible process.
(b) Discuss the heat engine and refrigerator cycle with the help of a neat sketch.

Q.8 Explain the process of steam generation. Show the various stages on p-v and T-s diagrams.

Enrollment No……

Master of Technology
First Semester Main Examination, Dec-2020
Heat and Mass Transfer [MTTPE103]

Time: 3:00 Hrs **Max Marks 70**

Note: Attempt any five questions out of eight.
All questions carry equal marks.

Q.1 Write short notes on:-
(i) Applications of FDM in heat transfer
(ii) Conduction shape factor-details
(iii) Time constant of thermocouple-calculation method

Q.2 (a) Derive the equation for temperature distribution for Newtonian heating/cooling process.

(b) Significance of Nusselt number and Prandtl number in free convection.

Q.3. (a) Explain the regimes of flux plot.

(b)Derive the temperature distribution and heat transfer rate through infinitely long fin.

Q.4. (a) A steam pipe of 120 mm OD is covered with two layers of lagging inside being 45mm thick (k=0.08 w/m-k) and outside layer of 30mm thick (k=0.12 w/m-k). Pipe conveys steam at 20 bar with 500 C super heat, outside temperature of lagging is 250 C and length of steam pipe is 30m long. Calculate heat lost per hr, interface temperature of lagging.

(b) Derive the equation for heat transfer with variable thermal conductivity with temperature.

Q.5. (a) Helium gas is stored at 200C in a spherical container of fused silica (SiO2) which has a diameter of 0.20m and a wall thickness of 2mm. If the container is charged to an initial pressure of 4 bars, what is the rate at which this pressure decreases with time? Properties of helium fused silica at 293K are, a). Mass diffusion coefficient = 0.4x 10-13 m2/s and b). Solubility S= 0.45 x 10-3 k-mol/m3 bar.

(b) Based on Nusselt's assumptions, derive a correlation for the velocity profile of the condensate across its thickness, for film condensation process of pure vapors on a vertical plate.

Q.6. (a) A diffuse circular disc of diameter D and area Aj is kept parallel to a plane diffuse surface of area Ai <<Aj. Ai is located at a distance of L from the Centre of Aj.

(b) Time constant of thermo couple – calculation method.

Q.7 (a) Three sides of a thin rectangular plate are maintained at a constant temperature T1, while the fourth side is maintained at a constant temperature of T2 which is different form T1. Derive a general equation for temperature distribution along the plate.

(b) Derive a correlation between Colburn's j-factor and the local friction coefficient for flow over a flat plate for a Prandtl number equal to unity.

Enrollment No……

Master of Technology
First Semester Main Examination, Dec-2020
Advanced Fluid Mechanics (MTTPE 104)

Time: 3:00 Hrs **Max Marks 70**

Note: (i) Attempt any five questions out of eight.
(ii) All questions carry equal marks.
(ii)Draw suitable diagram and assume suitable data wherever required.

Q.1 (a) Explain the principle of continuation and write the statement for continuity - equation in three – dimensions.
(b) Explain-
i) Laminar and turbulent flow.
ii) Uniform and Non uniform flow.
iii) Steady and unsteady flow.

Q.2 (a) Describe the use and application of flow nets.
(b) Derive the pressure equation.

Q.3 (a) Discuss the separation of boundary – layer with a neat sketch.
(b) Discuss stagnation pressure in compressible flow.

Q.4 (a) Given a velocity field,

$$\bar{V} = (4 + xy + 2t)\hat{\imath} + 6x^3\hat{\jmath} + (2xt^2 + z)\hat{k}$$

find the acceleration of a fluid particle at (2, 4, 4) at t=3.
(b) Find the components of verticity at a point (1, 1, 2) for the following flow-

$u = 2x^3 + 3y$, [$v = -2xy + 9y^2 + 3zy^2$, $w = \frac{3}{4}z^2 + 2xz$]

Q.5 (a) Prove that the velocity of sound wave in a compressible fluid is given by

$C = \sqrt{\frac{K}{\varrho}}$, Where k = bulk modules of fluid

ϱ = density of fluid
(b) What is the relation between pressure and density of a compressible fluid for- i) Isothermal Process ii) Adiabatic Process

Q.6 (a) What do you understand by the characteristic curves of a turbine? Name the important types of characteristics curves.
(b) A radial flow hydraulic turbine is required to be designed to produce 18MW under a head of 18m at speed of 90rpm. A geometrical similar model with an output of 30Kw and a head of 4m is to be tested under similar dynamical condition at what speed the model must be run?

Q.7 (a) State the classification of hydraulic machines.
(b) Obtain expression for the work-done by an impellor of a centrifugal pump on water per second per unit weight of water.

Q.8 Write short note on (any four): (3.5x4 each)
(a) Prototype testing
(b) Control mass and control volume analysis
(c) N-S equations and its applications
(d) Concept of continuous

Enrollment No……

Master of Technology (Thermal Engineering)
First Semester Main Examination, Dec-2020
I.C. Engine and Alternate Fuels (MTTPE-105)

Time: 3:00 Hrs **Max Marks 70**

Note: (i) Attempt any five questions out of eight.
(ii)Draw suitable diagram and assume suitable data wherever required.

Q.1 **(a)** Explain theory of combustion in S.I. engine with suitable diagram. **(7)**

(b) Discuss various elements of MPFI system and also write its merits and demerits. (**7)**

Q.2 **(a)** Discuss different methods of supercharging used in practice. **(7)**

(b) What are the source of HC formation in petrol engine? **(7)**

Q.3 **(a)** Describe the working of duol fuel engine with neat sketch and discuss its performance characteristics. **(7)**

(b) Discuss the performance characteristics of variable compression ratio engine with conventional IC engine. **(7)**

Q.4 **(a)** Describe the working of rotary wankel engine with help of neat sketch. **(7)**

(b) Explain the effect of A:F ratio and spark advance on emission of NO_x. **(7)**

Q.5 **(a)** Compare ethanol and methanol as a substitute to gasoline. **(7)**

(b) Discuss different properties of H_2 if used as a substitute fuel for petrol. **(7)**

Q.6 **(a)** Explain multi fuel engine with neat sketch. **(7)**

(b) How air and sound is polluted by engine? Discuss remedial measures. **(7)**

Q.7 **(a)** Why do CI engine have greater potential than SI engine for improvement in power output and fuel economy as a result of turbo charging? When it is most appropriate to specify an inter-cooler? **(7)**

(b) Explain the principle difference between fixed jet and variable jet carburetor. **(7)**

Q.8 write down short note on any four. **(3.5x4 each)**

(i) Hydrogen storage
(ii) Advantage of electronic fuel injection
(iii) Modern trend in IC engine
(iv) Pumping losses
(v) Carburetion